

**IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
EL PASO DIVISION**

**VALEO, INC.; VALEO ELECTRICAL
SYSTEMS, INC.; and DELMEX DE
JUAREZ S. DE R.L. DE C.V.**

Plaintiffs,

v.

**FEDERAL-MOGUL CORP. and
FEDERAL-MOGUL VEHICLE
COMPONENT SOLUTIONS, INC.**

Defendants,

3:13-cv-115

Civil Action No. _____

JURY TRIAL DEMANDED

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiffs Valeo, Inc., Valeo Electrical Systems, Inc., and Delmex de Juarez S. de R.L. de C.V. (collectively, “Valeo”) hereby file this Complaint against Defendants Federal-Mogul Corp. and Federal-Mogul Vehicle Component Solutions (collectively, “Defendants”) for infringement of U.S. Patent Nos. 7,937,798 (the “798 Patent”), 8,220,106 (the “106 Patent”), and 7,891,044 (the “044 Patent”) (collectively, “Patents-In-Suit”).

PARTIES

1. Valeo, Inc. is a New York Corporation with its principal place of business at 150 Stephenson Highway, Troy, MI, 48083, and Valeo, Inc. d/b/a Valeo Service USA having a place of business at 301 West Park Lane, Hampton, Virginia 23666.

2. Valeo Electrical Systems, Inc. is a Delaware Corporation with its principal place of business at 150 Stephenson Highway, Troy, MI, 48083. Valeo Electrical Systems, Inc. conducts business at 5 Zane Grey St., El Paso, TX 79906-5223.

3. Delmex de Juarez S. de R.L. de C.V., *a sociedad anónima de capital variable* is a Corporation organized under the laws of Mexico, with its principal place of business at Avenida de las Torres y calle Intermex # 1681, Parque Industiral Intermex, Cd. Juarez, Chihuahua 32640.

4. Upon information and belief, Defendant Federal-Mogul Corp. is a corporation organized under the laws of Delaware and maintains its principal place of business at 26555 Northwestern Highway, Southfield, MI 48033. Upon information and belief, Defendant Federal-Mogul Corp. conducts business, both generally and as specifically related to the infringing products, in El Paso, TX, within the jurisdiction of this Court.

5. Upon information and belief, Defendant Federal-Mogul Vehicle Component Solutions, Inc. is a corporation organized under the laws of Delaware and maintains its principal place of business at Southfield, MI. Upon information and belief, beginning in 2012, Defendant Federal-Mogul Vehicle Component Solutions, Inc. has sold and distributed “a broad portfolio of products in the global aftermarket, while also serving original equipment manufacturers with products including braking, chassis, wipers and other vehicle components” on behalf of Defendant Federal-Mogul, Inc.

6. Upon information and belief, Defendant Federal-Mogul Corp. and/or Defendant Federal-Mogul Vehicle Component Solutions, Inc. operates a place of business at least at 1277 Joe Battle Blvd., El Paso, TX and imports infringing wiper blades through Federal Mogul facilities in El Paso, TX.

JURISDICTION AND VENUE

7. This lawsuit is an action for patent infringement arising under the patent laws of the United States, 35 U.S.C. §§ 1, *et seq.* This Court has jurisdiction over this action pursuant to 28 U.S.C. §§ 1331 and 1338.

8. Upon information and belief, Defendants are subject to personal jurisdiction in this Court because they are currently doing and have done substantial business in this judicial district, including: (i) employing numerous employees in this judicial district; (ii) designating an agent for service of process in this judicial district; (iii) regularly receiving shipments of infringing wiper devices within this judicial district; (iv) committing acts of patent infringement and/or contributing to or inducing acts of patent infringement by others in this judicial district and elsewhere in Texas and the United States; and (v) regularly doing business or soliciting business, engaging in other persistent courses of conduct, and/or deriving substantial revenue from products and/or services provided to individuals in this judicial district and in this State.

9. Venue is proper in this judicial district pursuant to 28 U.S.C. §§ 1391 and 1400(b) because Defendants regularly conduct business in this judicial district, have regular and established places of business in this judicial district, and/or because certain of the acts complained of herein occurred in this judicial district.

10. Joinder of Defendants is proper pursuant to 35 U.S.C. § 299(a) at least because, on information and belief, as parent (Federal-Mogul Corp.) and subsidiary (Federal-Mogul Vehicle Component Solutions, Inc.), the manufacture, import, offer for sale, and/or sale of infringing windshield wiper products arise out of the common actions of the Defendants. Questions of fact common to both Defendants will arise in the action at

least because, upon information and belief, Defendants' infringement arises from their common acts of manufacturing, importing, offering for sale, and selling infringing windshield wiper products.

PATENTS-IN-SUIT

11. Valeo is the owner by assignment of U.S. Patent No. 7,937,798, entitled "Device for Detachably Linking a Wiper Blade with a Driven Wiper Arm," duly and legally issued on May 10, 2011. The '798 patent is appended hereto as Exhibit A.

12. Valeo is the owner by assignment of U.S. Patent No. 8,220,106, entitled "Device for Detachably Linking a Wiper Blade with a Driven Wiper Arm," duly and legally issued on July 17, 2012. The '106 patent is appended hereto as Exhibit B.

13. Valeo is the owner by assignment of U.S. Patent No. 7,891,044, entitled "Device for Detachably Linking a Wiper Blade with a Driven Wiper Arm," duly and legally issued on February 22, 2011. The '044 patent is appended hereto as Exhibit C.

FIRST CLAIM FOR RELIEF

(Infringement of U.S. Patent No. 7,937,798)

14. On information and belief, Defendants manufacture, import, offer for sale, and sell certain windshield wiper products that infringe the '798 patent. For example, on information and belief, Defendants manufacture, import, offer for sale, and sell certain windshield wiper products, including Defendants' A-22-M, A-22-OE and SP-21 ANCO Profile Wiper Blades and products with similar wiper adapters; C-21-OE ANCO Contour Premium Wiper Blades and products with similar wiper adapters; 60-020-PP NAPA Accufit Blades and products with similar wiper adapters; and 60-2243-1 NAPA Vista Blades and products with similar wiper adapters, that infringe the '798 patent.

15. Defendants have been provided notice of their infringement of the '798 patent.

16. On information and belief, the infringement by Defendants has been willful.

Defendants were made aware of the family of patents to which the '798 patent belongs.

On information and belief, therefore, Defendants have known of the '798 patent, and their actions resulting in infringement of the '798 patent have been objectively reckless.

17. Valeo has been irreparably damaged by such infringement and will continue to be irreparably damaged by such infringement unless enjoined by the Court.

SECOND CLAIM FOR RELIEF

(Infringement of U.S. Patent No. 8,220,106)

18. On information and belief, Defendants manufacture, import, offer for sale, and sell certain windshield wiper products that infringe the '106 patent. For example, on information and belief, Defendants manufacture, import, offer for sale, and sell certain windshield wiper products, including Defendants' A-22-M, A-22-OE and SP-21 ANCO Profile Wiper Blades and products with similar wiper adapters; C-21-OE ANCO Contour Premium Wiper Blades and products with similar wiper adapters; 60-020-PP NAPA Accufit Blades and products with similar wiper adapters; and 60-2243-1 NAPA Vista Blades and products with similar wiper adapters, that infringe the '106 patent.

19. Defendants have been provided notice of their infringement of the '106 patent.

20. On information and belief, the infringement by Defendants has been willful.

Defendants were made aware of the family of patents to which the '106 patent belongs.

On information and belief, therefore, Defendants have known of the '106 patent, and their actions resulting in infringement of the '106 patent have been objectively reckless.

21. Valeo has been irreparably damaged by such infringement and will continue to be irreparably damaged by such infringement unless enjoined by the Court.

THIRD CLAIM FOR RELIEF

(Infringement of U.S. Patent No. 7,891,044)

22. On information and belief, Defendants manufacture, import, offer for sale, and sell certain windshield wiper products that infringe the '044 patent. For example, on information and belief, Defendants manufacture, import, offer for sale, and sell certain windshield wiper products, including Defendants' A-22-M, A-22-OE and SP-21 ANCO Profile Wiper Blades and products with similar wiper adapters; C-21-OE ANCO Contour Premium Wiper Blades and products with similar wiper adapters; 60-020-PP NAPA Accufit Blades and products with similar wiper adapters; and 60-2243-1 NAPA Vista Blades and products with similar wiper adapters, that infringe the '044 patent.

23. Defendants have been provided notice of their infringement of the '044 patent.

24. On information and belief, the infringement by Defendants has been willful. Defendants were made aware of the family of patents to which the '044 patent belongs. On information and belief, therefore, Defendants have known of the '044 patent, and their actions resulting in infringement of the '044 patent have been objectively reckless.

25. Valeo has been irreparably damaged by such infringement and will continue to be irreparably damaged by such infringement unless enjoined by the Court.

REQUEST FOR A JURY TRIAL

26. Valeo requests a jury trial of all issues in this action so triable.

PRAYER FOR RELIEF

WHEREFORE, Valeo prays for the following relief:

(a) That Defendants be ordered to pay damages adequate to compensate Valeo for Defendants' infringement of each of the Patents-In-Suit pursuant to 35 U.S.C. § 284;

(b) That Defendants be ordered to pay increased and treble damages for Defendants' willful infringement of each of the Patents-In-Suit pursuant to 35 U.S.C. § 284;

(c) That Defendants be ordered to pay attorneys' fees pursuant to 35 U.S.C. § 285 for each of the Patents-In-Suit;

(d) That Defendants, its officers, agents, servants, employees, and those persons acting in active concert or in participation with them be enjoined from further infringement of each of the Patents-In-Suit pursuant to 35 U.S.C. § 283;

(e) That Defendants be ordered to pay prejudgment interest;

(f) That Defendants be ordered to pay all costs associated with this action; and

(g) That Valeo be granted such other and additional relief as the Court deems just and proper.

RESPECTFULLY SUBMITTED,

/s/ Richard G. Munzinger

Dated: April 10, 2013

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Exhibit A



US007937798B2

(12) **United States Patent**
Fink et al.

(10) **Patent No.:** **US 7,937,798 B2**
(45) **Date of Patent:** **May 10, 2011**

(54) **DEVICE FOR DETACHABLY LINKING A WIPER BLADE WITH A DRIVEN WIPER ARM**

(75) Inventors: **Andreas Fink**, Grossbottwar (DE);
Wolfgang Scholl, Gemmrigheim (DE);
Gerhard Schremmer,
Bietigheim-Bissingen (DE)

(73) Assignee: **Valeo Wischersysteme GmbH**,
Bietigheim-Bissingen (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **12/778,268**

(22) Filed: **May 12, 2010**

(65) **Prior Publication Data**

US 2010/0218330 A1 Sep. 2, 2010

Related U.S. Application Data

(63) Continuation of application No. 10/536,054, filed as application No. PCT/EP03/13062 on Nov. 21, 2003, now Pat. No. 7,891,044.

(30) **Foreign Application Priority Data**

Nov. 26, 2002 (DE) 102 54 978
May 27, 2003 (DE) 103 23 997

(51) **Int. Cl.**
B60S 1/40 (2006.01)

(52) **U.S. Cl.** **15/250.32; 15/250.351**

(58) **Field of Classification Search** .. 15/205.31–250.33,
15/250.201, 250.351, 250.43, 250.44
See application file for complete search history.

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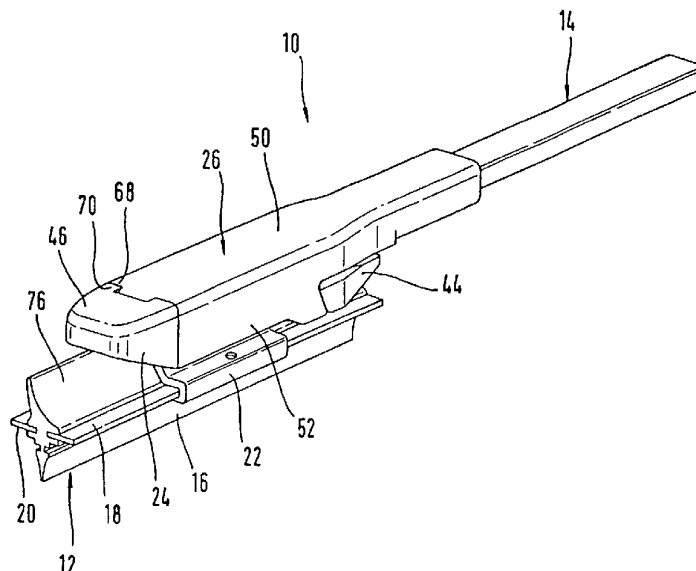
Primary Examiner — Dung Van Nguyen

(74) *Attorney, Agent, or Firm* — Oblon, Spivak, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

A wiper blade assembly for a windshield wiper. In one embodiment, the wiper blade assembly includes a connector pivotably mounted on a blade support element. The connector has a receiving portion shaped to receive a first part of the end portion of a wiper arm and further has a securing portion shaped to secure a second part of the end portion of the wiper arm.

17 Claims, 6 Drawing Sheets



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Fig. 3

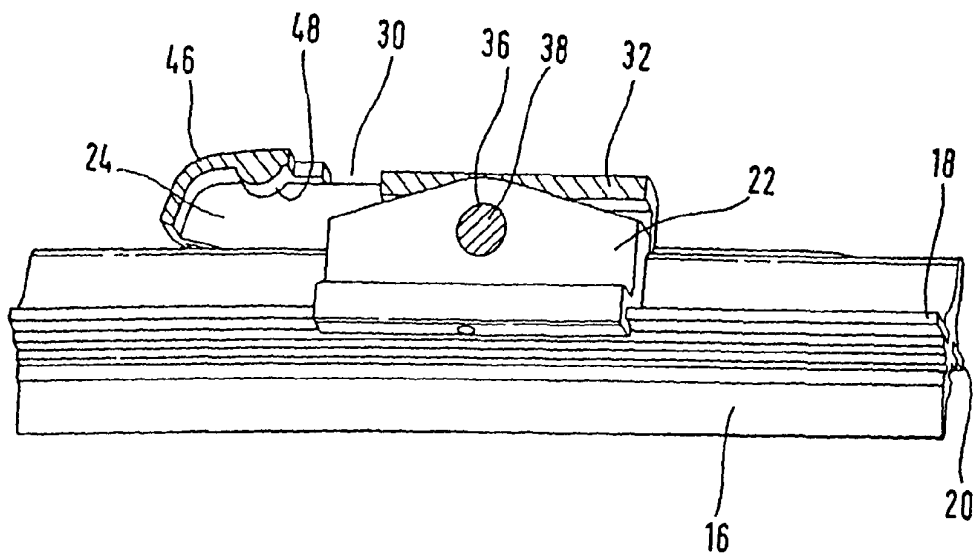
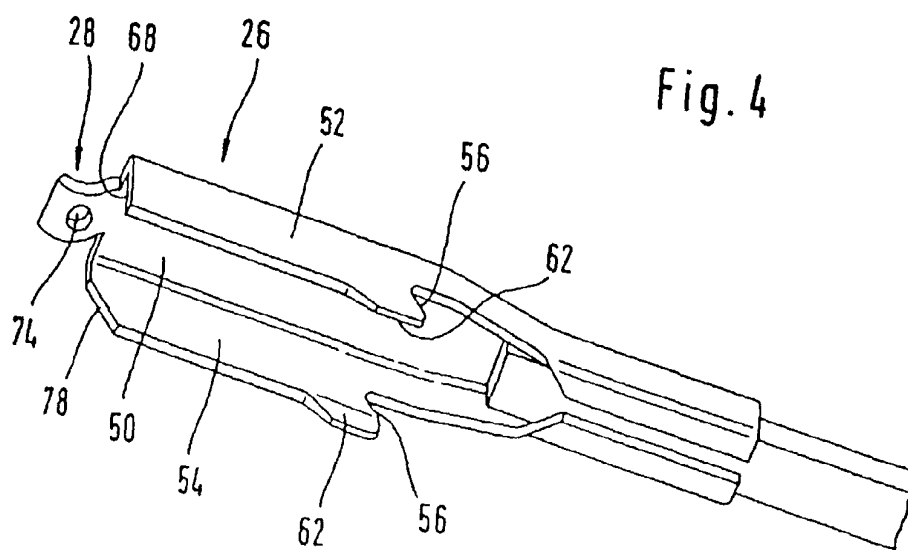


Fig. 4



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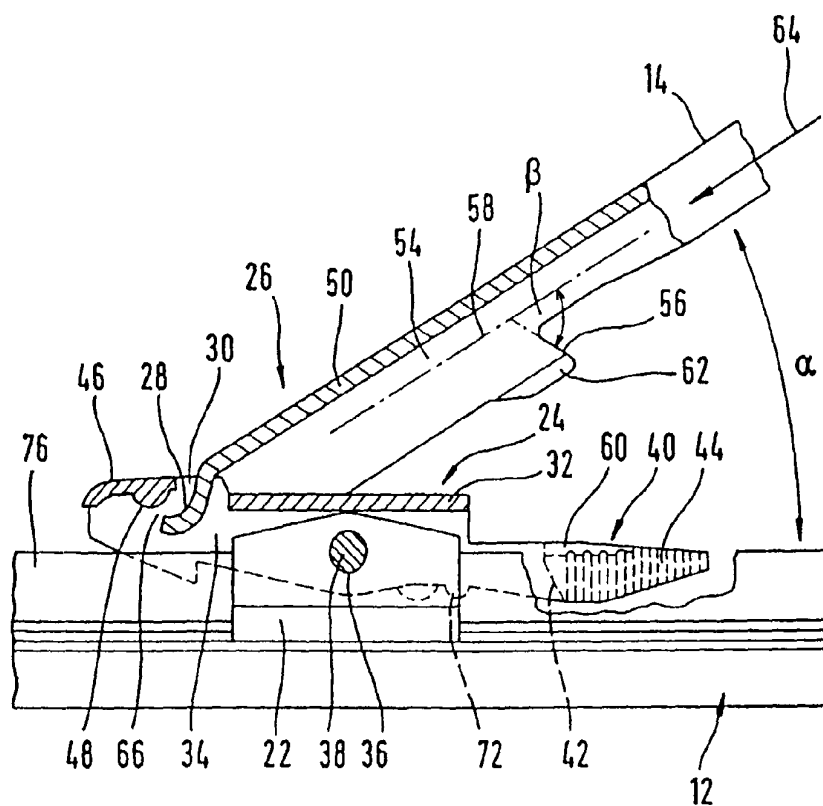


Fig. 5

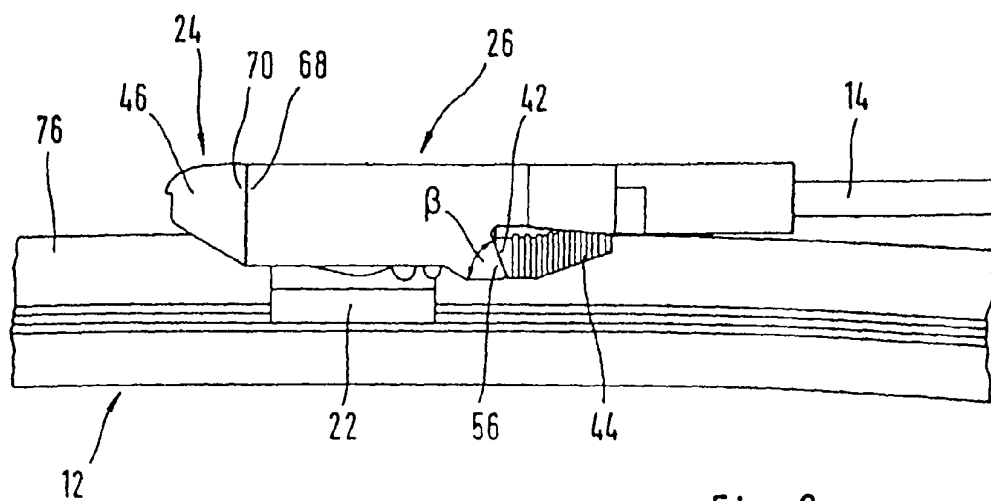


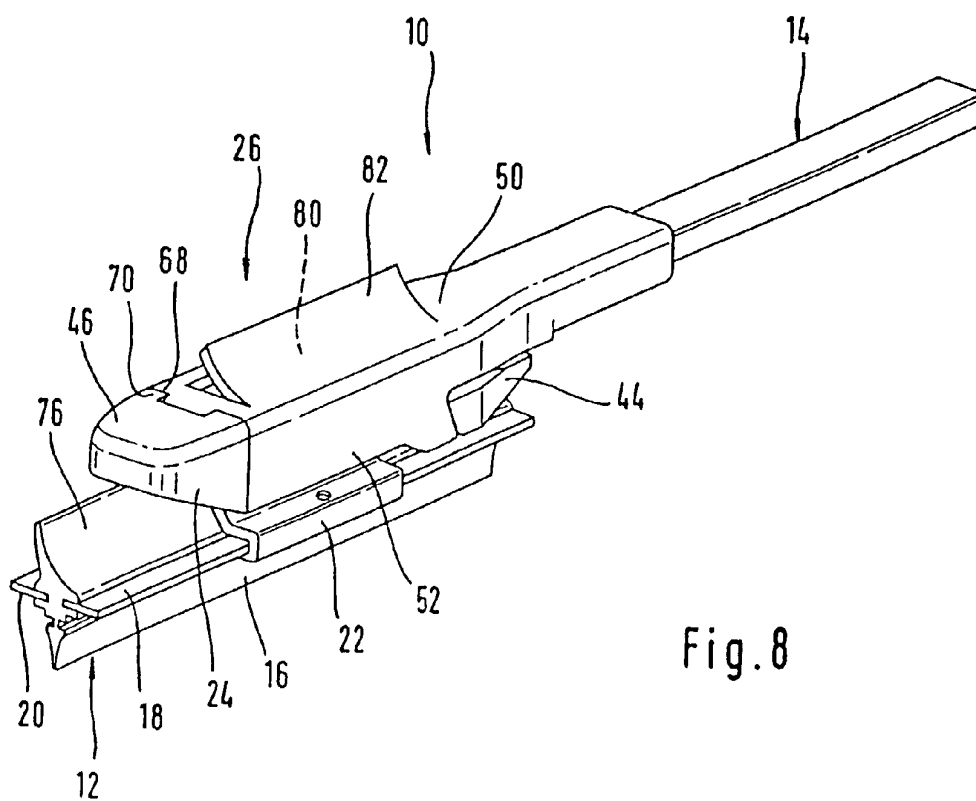
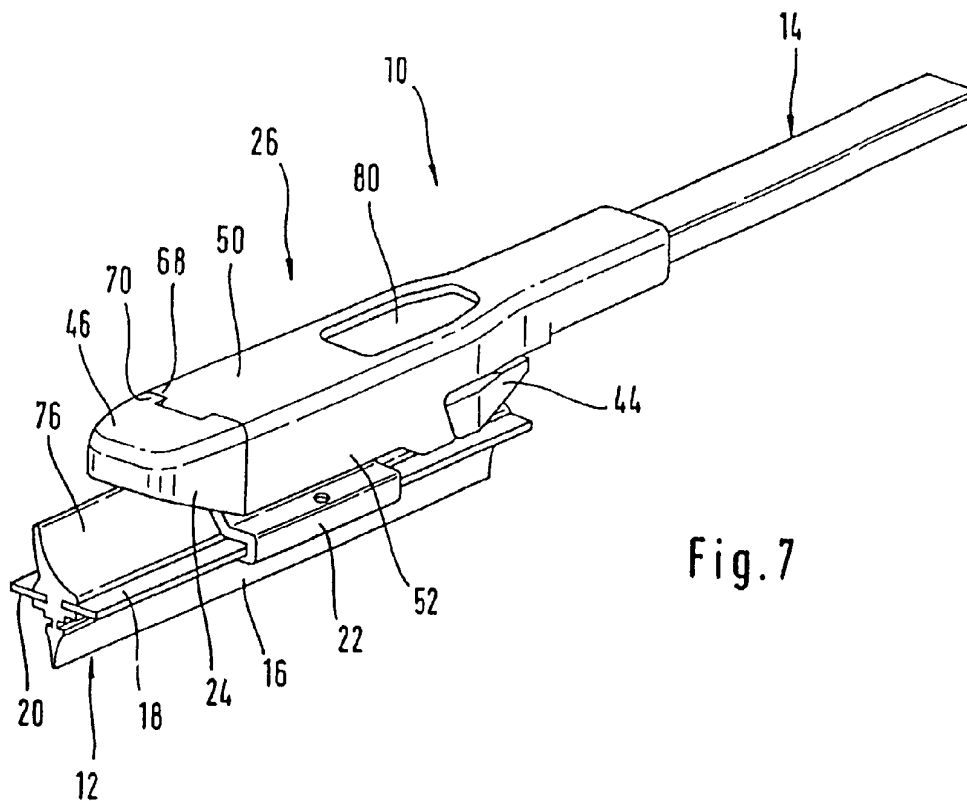
Fig. 6

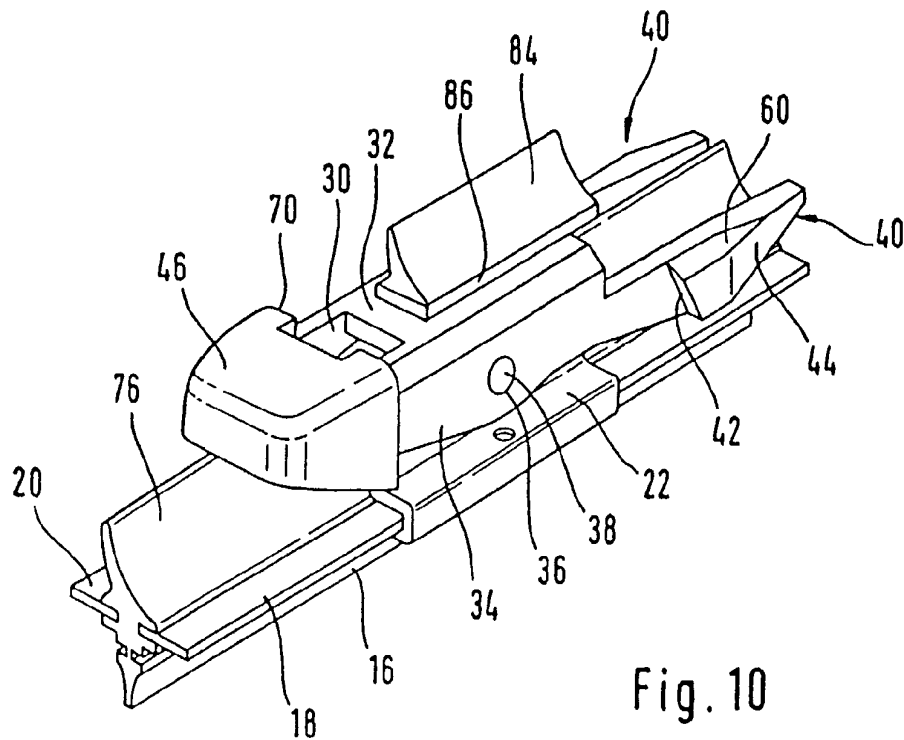
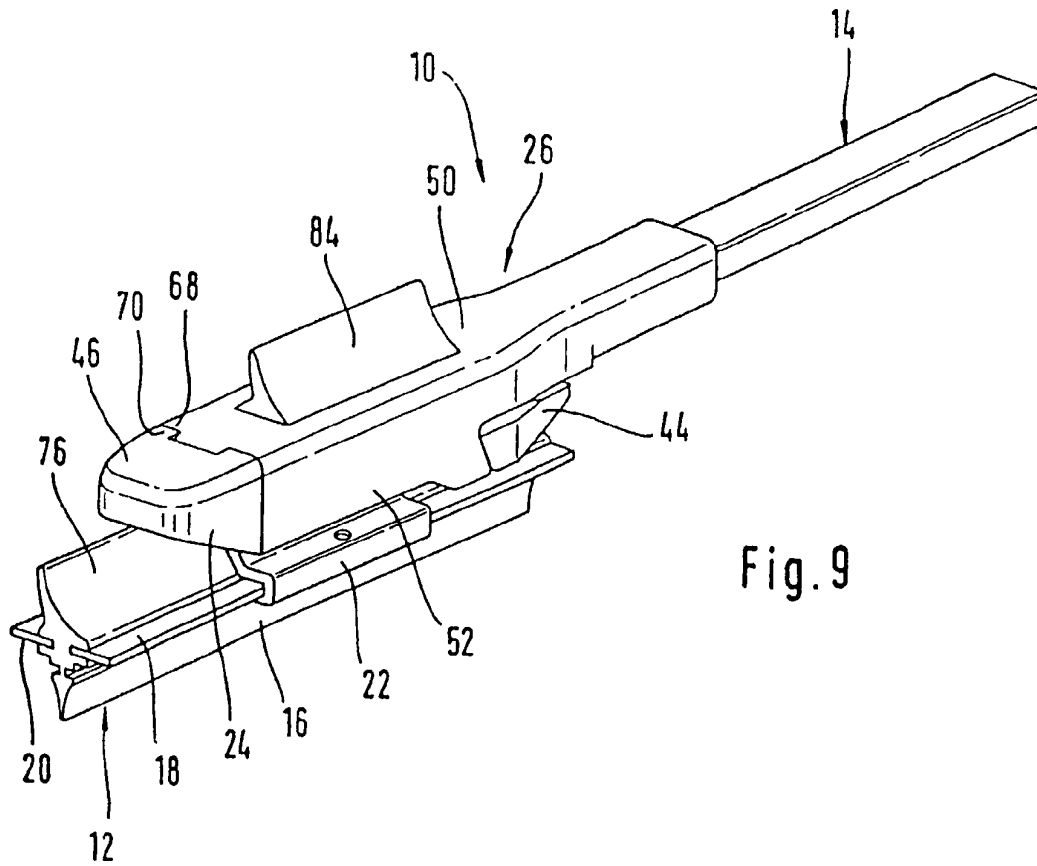
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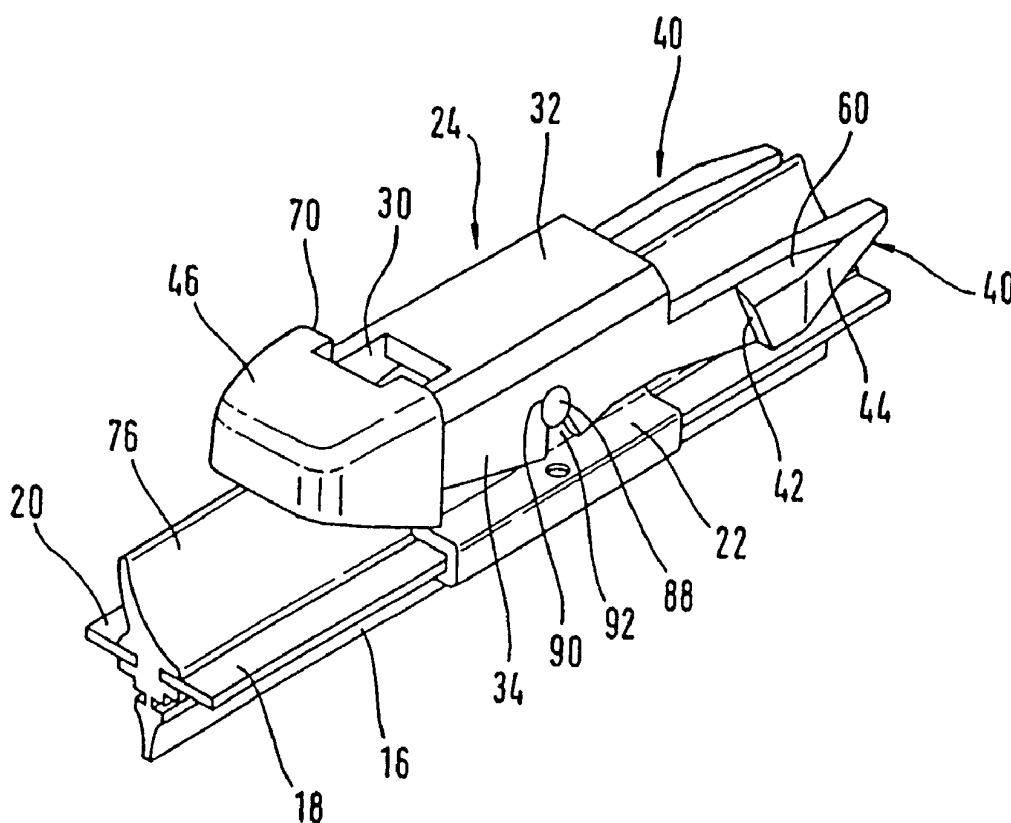


Fig. 11

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DEVICE FOR DETACHABLY LINKING A WIPER BLADE WITH A DRIVEN WIPER ARM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of pending U.S. application Ser. No. 10/536,054 filed Jan. 19, 2006, which is herein incorporated in its entirety by reference. U.S. application Ser. No. 10/536,054 is the National Stage application of PCT International Application No. PCT/EP2003/013062 filed Nov. 21, 2003, which claims the benefit of priority from German Patent Application Nos. 102 54 978.8 filed Nov. 26, 2002 and 103 23 997.9 filed May 27, 2003.

The invention relates to a device and a method for releasably connecting a wiper blade to a drivable wiper arm, wherein the wiper blade comprises a wiper strip which faces the windscreen to be wiped, at least one strip-like elongate support element, a slide element which is connected to the support element, and a connecting element for connection to a coupling section of the wiper arm, which connecting element is mounted on the slide element in a manner such that it can pivot.

Such a device is known for example from WO 02/40328 A1. The device described therein, by means of which a flat wiper blade can be connected to the coupling section, has a large number of complex components which are difficult to manufacture. Moreover, the operation of connecting the coupling section of the wiper arm to the connecting element of the wiper blade is relatively complex and requires a certain amount of skill.

It is therefore an object of the present invention to propose a device for releasably connecting a wiper blade to a drivable wiper arm, in which the operation of connecting the connecting element to the coupling section can be carried out in a simple manner. Moreover, it is to be ensured that the coupling section is joined in a permanently secure manner to the connecting section, wherein the wiper blade can nevertheless be released from the wiper arm in a simple manner.

According to the invention, this object is achieved by a device of the type described above in that the coupling section has a tongue-like insertion section, in that the connecting element has a seat for the insertion section, and in that the coupling section and the connecting element have securing sections for providing a mutual permanent connection, wherein, in order to reach a preassembly position in which the longitudinal axis of the wiper arm and the longitudinal axis of the connecting element enclose an angle α in the range from approximately 10° to 100° , the insertion section can be inserted in a substantially rectilinear manner into the seat, and wherein, in order to reach a final assembly position, the wiper arm and the connecting section can be pivoted onto one another about the insertion section/seat contact area until the securing sections allow a permanent mutual connection.

The invention has the advantage that only two steps which are simple to carry out are required in order to connect the wiper blade to the wiper arm, namely firstly rectilinear insertion of the insertion section into the seat provided on the connecting element, and pivoting of the coupling section or of the wiper arm and of the connecting element onto one another.

Moreover, such a device has the advantage that it is of a very flat and very narrow design. On the one hand, wind noise is minimized as a result. On the other hand, the view of the vehicle driver is only slightly impaired by the wiper blade and the wiper arm. Furthermore, force introduction preferably

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takes place over the longitudinal axis of the wiper blade, substantially perpendicular to the windscreen to be wiped, and as a result the occurrence of tilting moments is suppressed.

5 Preferably, the insertion direction for reaching the preassembly position lies in the plane of pivoting for reaching the final assembly position. This has the advantage that the two movements lie in one plane, and as a result the assembly operation is simplified.

10 One embodiment of the invention is characterized in that the coupling section is designed to be U-shaped in cross section and comprises a back and two legs, wherein the insertion section is designed in a hook-like manner and is arranged in a stand-alone manner on the back of the coupling section.

15 The coupling section, which is designed to be U-shaped in cross section, advantageously engages over the connecting element at least in part in the final assembly position. As a result, transverse forces acting on the connecting element can be absorbed by the legs of the coupling section.

20 The insertion section is preferably designed such that it is arc-shaped at the free end, in the direction of the extension of the wiper arm and in side view in the direction of the windscreen to be wiped, in such a manner that it does not protrude beyond the back. This has the advantage that the insertion section, in the final assembly position, does not protrude in a disruptive manner beyond the back of the coupling section. Given a suitably designed connecting element, the insertion section is not visible in the final assembly position.

It is advantageous if the region of the connecting element which cooperates with the insertion section and adjoins the insertion opening is designed to be complementary to the insertion section. In this way it can be ensured, in the final assembly position, that the insertion section bears reliably against the complementarily designed region of the connecting element.

A further embodiment of the invention is obtained when the region of the connecting element and of the insertion section which cooperates with the insertion section is designed to be arc-shaped, and in particular shaped like a segment of a circle, in longitudinal section. When the coupling section and the connecting element are pivoted onto one another in the final assembly position, this ensures that during the pivoting movement the insertion section bears with a substantial part of its surface against the region of the connecting element which cooperates with the insertion section. This ensures reliable guidance when assembling the device from the preassembly position to the final assembly position. Stress peaks are avoided on account of the large-surface bearing.

50 One further embodiment is obtained when the connecting element is designed to be U-shaped in cross section and comprises a back and two legs. On account of the U-shaped design of the connecting element, a spoiler section of the wiper strip which faces away from the windscreen to be wiped can extend between the two legs of the connecting element in the longitudinal direction of the wiper blade. Furthermore, the connecting element can advantageously be coupled at the legs to the slide.

Advantageously, the insertion opening is designed as a cut-out on the back. This has the advantage that the insertion opening can be clearly seen on the wiper blade in plan view, as a result of which insertion of the insertion section into the insertion opening is simplified.

65 According to the invention, it is furthermore conceivable that, in the final assembly position, the coupling section covers the connecting element at least in part. In the state mounted on the wiper arm, the inner sides of the legs of the

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U-shaped coupling section then preferably bear against the outer sides of the legs of the U-shaped connecting element. The outer side of the back of the connecting element preferably bears against the inner side of the back of the coupling section.

A further advantageous embodiment of the invention is obtained when the securing sections are designed as locking sections. When the coupling section and the connecting element are pivoted onto one another, the locking sections advantageously lock with one another in the final assembly position.

It may be provided that the connecting element has, on its side facing away from the insertion opening in the longitudinal direction, on the legs, in each case a locking tongue which extends in the longitudinal direction and is elastically flexible in the transverse direction, which locking tongues cooperate with locking edges provided on the legs of the coupling section.

In order to ensure secure locking, it may advantageously be provided that the locking edges of the locking tongues and the locking edges of the legs enclose an acute angle, in particular an angle in the range from approximately 30° to 80°, with the longitudinal axis of the wiper blade in the final assembly position.

In order to release the locking connection, and thus to release the wiper blade from the wiper arm, in a further embodiment of the invention it may be provided that actuating sections are provided on the free ends of the locking tongues. The actuating sections are designed in such a way that the locking tongues can be pressed towards one another, as a result of which the locking edges of the locking tongues can come out of engagement with the locking edges on the legs of the coupling section.

In order to allow easier locking, it is advantageously provided that the sides of the locking tongues which face the back of the coupling section and meet the legs of the coupling section when pivoted into the final assembly position are bevelled.

Easier locking is also assisted if the sides of the legs of the coupling section which face the windscreen and which are met by the facing sides of the locking sections when pivoted into the final assembly position are bevelled. Shortly prior to reaching the final assembly position, the bevelled sides of the locking tongues consequently cooperate with the bevelled sides of the legs of the coupling section in such a way that the locking tongues are pivoted out in directions towards one another. In the final assembly position, the locking tongues snap behind the locking edges of the coupling section in directions facing away from one another.

In order to prevent a wiper blade from being arranged the wrong way round on a wiper arm, the coupling section may have a suitable coding. Incorrect assembly of the wiper blade, for example on the incorrect wiper arm, is thus prevented. A coding may be produced for example by a suitable bezel on the coupling section and by a suitable web on the connecting element which cooperates with the bezel.

A further advantageous embodiment of the invention is obtained when the legs of the connecting element are designed as double-walled legs which are slightly elastically flexible in the transverse direction. Such double-walled legs have a better friction behaviour with respect to the slide element against which they are pivotably arranged. Advantageously, the connecting element has, between the legs, a hinge pin which is mounted in a hole on the slide element for the pivotable arrangement of the connecting element.

Another embodiment of the invention provides that the slide element has a bearing bolt or alternatively two hinge

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pins which project with their ends from the slide element and on which the connecting element is pivotably mounted by bearing holes in its legs, which bearing holes are designed in a corresponding manner and are arranged so as to be aligned.

In this case, the bearing bolt is or the bearing pins are connected fixedly against rotation to the slide element, and the connecting element is mounted on the slide element in a manner such that it can rotate or pivot. When a wiper blade is replaced, therefore, the entire bearing device is exchanged.

According to a further embodiment of the invention, the bearing holes provided in the legs of the connecting element are opened above in each case a slot towards the edge, which slot runs radially with respect to the bearing hole. This may advantageously be used to simplify the assembly of the individual parts.

According to another embodiment, if the slot in each case runs from the bearing hole to the edge of the leg which lies opposite the back of the connecting element, the risk of the bearing bolt or bearing pin undesirably sliding out of the bearing hole is small.

One further advantageous embodiment provides that in each case the slot expands from the bearing hole towards the edge of the leg, wherein the narrowest point of the slot is smaller than the diameter of the bearing bolt or the alternative bearing pins. This embodiment allows simplification of assembly and disassembly. The bearing bolt or bearing pins can be pressed in radially through the slot in the manner of a locking connection, negotiating the narrow point. Likewise, the bearing bolt or bearing pins can also be removed in the opposite direction, again negotiating the narrow point. To this end, it may be necessary for the connecting element to be made of a suitable plastics material which allows the narrow point of the slot to be negotiated by the bearing bolt or bearing pins. The slide element and/or the bearing bolt or the bearing pins may be made of metal or likewise made of a suitable plastics material.

A further, advantageous embodiment of the invention provides that the legs of the connecting element have stud-like raised areas on the side facing the windscreen. These raised areas serve for support on either the wiper rubber or the support element, as a result of which easier assembly and disassembly of the wiper blade is made possible.

The coupling section and the connecting element are preferably designed in such a way that, in the final assembly position, they have a substantially closed and substantially smooth surface. To this end, the sections of the connecting element which are covered by the coupling section may lie deeper than the sections of the connecting element which are visible in the final assembly position, the difference in depth being the wall thickness of the coupling section.

Further advantageous refinements are provided in order to improve the aerodynamic behaviour of the wiper arm/wiper blade combination, particularly at high travelling speeds or airflow velocities, and thus to counteract in particular the known effect of lifting of the wiper blade connected to the wiper arm off the windscreen to be wiped.

By virtue of the measure that the coupling section of the wiper arm has at least one opening suitable for air to flow through, a dynamic pressure which arises below the U-shape of the coupling section is substantially broken down. As a result, the lifting force on the wiper arm is reduced.

It is particularly advantageous to provide the at least one opening in the back of the coupling section. However, an improvement is also possible if one or more airflow openings are placed in the legs of the coupling section, in particular in the lee-side leg. The maximum effect can probably be achieved by a combination of the individual possibilities.

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Another embodiment provides that at least one spoiler-like air guide means is provided on the coupling section of the wiper arm. In this way, the incoming air can be guided in such a way that the effect of the wiper blade or wiper arm being lifted off the windscreen is counteracted. It is advantageous in this connection for the at least one air guide means to be arranged on the back of the coupling section. A spoiler acts particularly effectively at this location.

The advantages of an embodiment, according to which the air guide means is formed by a section cut free from the back of the coupling section and bent upwards in a spoiler-like manner, are to be seen in the combination of the effects of the spoiler and of the airflow opening formed in this way. The pressing force is thus directly increased and at the same time the dynamic pressure inside the coupling section is reduced. Moreover, an air guide means produced in this way is particularly cost-effective.

A further advantageous embodiment provides that at least one spoiler-like air guide means which is preferably made in one piece with the connecting element is arranged on the back of the connecting element, and that this at least one air guide means protrudes through a, preferably corresponding, opening in the back of the coupling section. Since the connecting element is advantageously made of plastics material, a very large number of design possibilities are provided for the shape of the spoiler-like air guide means with regard to particularly favourable fluidic properties.

The object mentioned in the introduction is also achieved by a method of assembling a device according to the invention, which method is characterized in that, in order to reach a preassembly position in which the longitudinal axis of the wiper arm and the longitudinal axis of the connecting element enclose an angle α in the range from approximately 10° to 100° , the insertion section is inserted in a substantially rectilinear manner into the seat, and in that, in order to reach a final assembly position, the wiper arm and the connecting section can be pivoted onto one another about the insertion section/seat contact area until the securing sections enter into a permanent mutual connection.

Further details and advantages of the invention can be found in the following description in which the invention is described and explained in more detail with reference to examples of embodiments shown in the drawings.

In the drawings:

FIG. 1 shows a device according to the invention in a perspective view;

FIG. 2 shows the device of FIG. 1 without the wiper arm;

FIG. 3 shows a partial section through FIG. 2;

FIG. 4 shows a view from below of the coupling section shown in FIG. 1;

FIG. 5 shows a partial section through the device of FIG. 1 in a preassembly position;

FIG. 6 shows a partial section through the device of FIG. 5 in the final assembly position;

FIG. 7 shows another embodiment of a device according to the invention in a perspective view;

FIG. 8 shows a further embodiment of a device according to the invention in a perspective view;

FIG. 9 shows a final embodiment of a device according to the invention in a perspective view;

FIG. 10 shows the device of FIG. 9 without the wiper arm; and

FIG. 11 shows another embodiment of a device according to the invention without the wiper arm.

FIG. 1 shows a device 10 according to the invention for releasably connecting a wiper blade 12, shown in part, to a drivable wiper arm 14 which is likewise shown in part. The

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wiper blade 12 has a wiper strip 16 which faces the windscreen to be wiped (not shown) and comprises two strip-like elongate support elements 18, 20, a slide element 22 which is connected to the support elements 18, 20, and a connecting element 24 which is arranged on the slide element 22 in a manner such that it can pivot. The connecting element 24 serves for connection to a coupling section 26 on the wiper arm 14.

The coupling section 26 has, as can be seen in particular in FIG. 4, a tongue-like insertion section 28 which, in the final assembly position shown in FIGS. 1 and 6, engages in a seat 30 which can be clearly seen in FIG. 2. The connecting element 24, which like the coupling section 26 is U-shaped in cross section, has a back 32 and two legs 34. The seat 30 is provided in the back 32 of the connecting element 24. A bearing hole 36 for a bearing bolt 38, which bearing hole extends in the transverse direction, is provided on the legs 34 of the connecting element 24. On account of the bearing hole 36, and the bearing bolt 38, a pivoting arrangement of the connecting element 24 with respect to the slide element 22 is obtained. In order to achieve a certain flexibility of the legs 34 while having sufficient stiffness, the legs 34 are designed to be double-walled.

As can likewise be seen from FIG. 2, the connecting element 24 has, on its side facing away from the insertion opening 30 in the longitudinal direction, on the legs 24, in each case a locking tongue 40 which extends in the longitudinal direction and is elastically flexible in the transverse direction. The locking tongues 40 each comprise a locking edge 42 and an actuating section 44. The region of the connecting element 24 which is covered by the coupling section 26 in the final assembly position is set back from the other regions of the connecting element 24 which are formed essentially by the two actuating sections 44 and a head section 46 which lies in the axial extension of the coupling section. As a result, in the final assembly position, the coupling section 26 and the connecting element 24 form a substantially closed and substantially smooth surface.

As can be seen from FIG. 3, the region 48 which cooperates with the insertion section 28 and adjoins the insertion opening 30 is designed to be complementary to the insertion section 28. As can be seen from FIGS. 4 and 5, the insertion section 28 is designed in an arc-shaped manner in the direction of the extension of the wiper arm 14 and in side view in the direction of the windscreen to be wiped. Correspondingly, as can be seen from FIGS. 3 and 5, the region 48 is likewise designed to be arc-shaped, in particular in the shape of a segment of a circle.

It can be seen from FIG. 4 that the coupling section is designed in a U-shaped manner in cross section and has a back 50 and legs 52, 54 which adjoin the back. The insertion section 28 is in this case arranged in a stand-alone manner in the extension of the back 50. Provided on the legs 52, 54 are locking edges 56 which enclose an angle β of approximately 70° with the longitudinal axis 58 of the wiper arm 14 (FIGS. 5 and 6). The locking edges 42 of the locking tongues 40 enclose a corresponding angle β . In the final assembly position shown in FIG. 6, the locking edges 42 of the locking tongues 40 bear against the locking edges 56 of the legs 52, 54 of the coupling section 26.

It can be seen from FIGS. 2 and 5 that the sides 60 of the locking tongues 40 which face the back 50 of the coupling section 26 are slightly bevelled. In a corresponding manner, the sides 62 of the legs of the coupling section 26 which face the windscreen and cooperate with the sides 60 of the coupling section 26 when pivoted into the final assembly position are also slightly bevelled.

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For assembly of the coupling section 26 to the connecting element 24, in order to reach a preassembly position which is shown in FIG. 5, the insertion section 28 is inserted into the seat 30 in a substantially rectilinear manner in the direction of the arrow 64. In this preassembly position, the longitudinal axis of the wiper arm 14 and the longitudinal axis of the connecting element 24 or of the wiper blade 12 enclose an angle α which may lie in the range from approximately 10 to 100°. In the example of embodiment shown in FIG. 5, the angle α has a value of approximately 40°. In order to reach the final assembly position, which is shown in FIG. 1 and FIG. 6, the wiper arm 14 and the connecting section 24 are pivoted onto one another about the contact area 66 in which the insertion section 28 bears against the region 48 of the seat 30. On account of the complementary design of the insertion section 28 and the region 48, the pivoting operation is carried out to a limited extent. Shortly prior to reaching the final assembly position, the bevelled sides 62 of the coupling section 26 and the correspondingly bevelled sides 60 of the locking tongues 40 meet one another in such a way that the locking tongues 40 are pivoted elastically in a direction facing one another. Upon reaching the final assembly position, the locking tongues 40 snap behind the locking edges 56 of the legs 52, 54 of the coupling section 26 in a direction facing away from one another. As a result, the coupling section 26 is permanently held on the connecting element 24 in the final assembly position. In the final assembly position, the coupling section 28 bears against the region 48 of the connecting element 24 over a large part of its surface. Furthermore, the end side 68 of the coupling section 26 which faces the head area 46 of the connecting element 26 bears against a bearing edge 70 of the connecting element which corresponds thereto.

On account of the locking edges 42, 56 which are not perpendicular to the longitudinal axis of the wiper blade but rather enclose an acute angle β with the longitudinal axis, in the assembled state the coupling section 26 is acted upon in the direction of the head section 46. As a result, a play-free connection is obtained in the axial direction. Moreover, by virtue of the obliquely arranged locking edges 42, 56, the coupling section 26 is acted upon in the direction of the wiper blade 12, as a result of which a play-free connection is produced in the direction perpendicular to the wiper blade. The insertion section 28 in this case bears against the contact region 48 of the connecting element 24 with slight prestress.

In order to release the connection, the actuating sections 44 are pressed towards one another. As a result, the locking edges 42 of the locking tongues 40 come out of the engagement region of the locking edges 56 of the coupling section 26. Since the actuating sections are arranged opposite one another, the actuating sections 44 can be pressed together by a simple hand grip, using one hand. The coupling section 26 is then pivoted away from the connecting element 24 until the preassembly position reached in FIG. 5 is almost reached. The insertion section 28 is then moved out of the seat 30 in the direction counter to the arrow 64.

As can be clearly seen in FIG. 5, it may be provided that the legs 34 of the connecting element have stub-like raised areas 72 on the side facing the windscreen. These raised areas serve for support on the slide element 22. The raised areas 22 restrict the pivoting range of the connecting element 24 with respect to the slide element 22. As a result, easier assembly and disassembly of the wiper blade 12 from the wiper arm 14 is possible.

In the bent region of the insertion section 28, a material cut-out in the form of a cylindrical hole 74 is provided.

In order to prevent it from being possible for the wiper blade, which has a spoiler-like projection 76 on its side facing

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away from the wiper strip 16, to be mounted on the incorrect wiper arm, a coding may be provided on the connecting element 24 and on the coupling section 26. Such a coding may be formed for example by a bevelled corner 78 on the leg 54 of the coupling section 26, as shown in a corresponding manner in FIG. 4. The bevelled corner 78 may in this case correspond to a material deposit at the corresponding location on the connecting element 24, which material deposit is designed in a complementary manner and is not shown in the figures. Since only one of two wiper blades, the respective right-hand or left-hand wiper blade, has a corresponding material deposit on the connecting element, a clear assignment of the right-hand or left-hand wiper blade to the right-hand or left-hand wiper arm is ensured.

For the example of embodiment shown in FIG. 7, in general the same description as above in respect of the first example of embodiment shown in FIGS. 1 to 6 applies. The same references have thus been used in FIG. 7 as in FIG. 1.

The essential difference of the example of embodiment shown in FIG. 7 is that an opening 80 is additionally provided in the back 50 of the coupling section 26 belonging to the wiper arm 14. This opening 80 makes it possible for air flowing below the U-shape of the coupling section to leave the space formed below the U-shape on a relatively short path by flowing through the opening 80. In this way, the dynamic pressure below the coupling section 26 is reduced compared to an embodiment without the opening 80, and this leads to a comparative reduction in the lifting force of the wiper arm 14 as air flows through.

Instead of the one opening 80, it would also be possible for a number of openings 80 to be provided in the coupling section 26, wherein one or more openings 80 may also be made in one of the two legs 52, 54 or in both legs 52, 54. The size, shape and position of the one or more openings 80 should be optimized with regard to as considerable an effect as possible in a manner depending on the geometric conditions of the individual components of the device 10 and of the device 10 as a whole. Likewise, the shape and size of the one or more openings 80 may be adapted to the design of the coupling section 26.

Also for the further example of embodiment shown in FIG. 8, the same description as that given above in respect of the first example of embodiment shown in FIGS. 1 to 6 applies.

The essential difference of the example of embodiment shown in FIG. 8 is that a spoiler-like air guide means 82 is formed on the back 50 of the coupling section 26. In order to produce the air guide means 82, a more or less rectangular section which is oriented in the longitudinal direction of the coupling section 26 has been cut free from or punched out of the back 50 of the coupling section 26, at its two narrow sides and on one longitudinal side, and bent upwards out of the plane of the back 50. In this case, the air guide means 82 may be given a rounded, wing-like shape. The air guide means 82 is connected on its longitudinal side facing the incoming air to the back 50. By virtue of the bending-out operation, the opening 80 in the back 50 is made at the same time behind the air guide means 82, which opening can be flowed through by a stream of air. In FIG. 8, the reference line belonging to reference 80 is shown in dashed line because the view of the opening 80 is hidden by the air guide means 82 in this perspective view. The air guide means 82 and the opening 80 may be produced from steel sheet as a punched and bent part in a cost-effective manner by punching and bending during the process of manufacturing the coupling section.

The aerodynamic advantages of such a design are on the one hand the pressing force produced by the air guide means, which pressing force acts on the wiper arm 14, and on the

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other hand the reduction in the dynamic pressure below the U-shape of the coupling section 26.

The special feature of the example of embodiment shown in FIGS. 9 and 10 is that an opening is provided in the back 50 of the coupling section 26 and that a spoiler-like air guide means 84 arranged on the back 32 of the connecting element 24 passes through this opening to the top side of the coupling section 26. When air flows across the air guide means 84, the pressing force of the wiper arm 14 is increased and the lifting force is reduced.

In FIG. 9, it can be seen that the shape and the size of the opening in the coupling section 26 and the base area of the air guide means 84 are adapted to one another. Moreover, the air guide means 84 is connected to the back 32 of the connecting element 24 via a pedestal 86. The height of the pedestal 86 corresponds to the wall thickness of the back 50 of the coupling section 26, so that the top side of the back 50 adjoins the air guide means 84 at least virtually free of any clearance or shoulder. As a result, the aerodynamics are improved and airflow noises are reduced.

Unlike the diagram in FIGS. 9 and 10, the opening in the back 50 of the coupling section 26 may advantageously also be greater than the base area of the air guide means 84 or the pedestal 86 thereof. In this case, only part of the opening would be filled by the air guide means 84. The part of the opening which is not filled thus acts as an airflow opening, and as a result the dynamic pressure below the U-shape of the coupling section 26 is in turn reduced. This embodiment is not shown in the drawing.

Another embodiment which is not shown in the drawing consists in that, in a device as shown in FIGS. 9 and 10, additionally at least one opening is provided in the back and/or in at least one of the legs 52, 54 for reducing the dynamic pressure below the U-shape of the coupling section 26.

A final example of embodiment is shown in FIG. 11. This example of embodiment corresponds in a very large number of features to the embodiment shown in FIG. 2, which is why the fundamental design will not be repeated here and the same reference numerals are used for identical parts and elements.

In the example of embodiment shown in FIG. 11, the slide element 22 has two bearing pins 88 which are arranged so as to be aligned with one another and which project from the slide element 22 transversely with respect to the longitudinal direction of the wiper blade 12. The bearing pins 88, only one of which can be seen in FIG. 11 on account of the perspective view, are made in one piece with the slide element 22. The slide element 22 will advantageously be manufactured as a whole as a diecast metal part or as an injection-moulded plastic part.

Bearing holes 90 which are aligned with one another are formed in the two legs 34 of the connecting element 24, said connecting element having essentially the shape of a U in cross section, once again only one of the bearing holes 90 being visible in FIG. 11 on account of the perspective view. The bearing holes 90 are adapted to the bearing pins 88 in such a way that pivoting of the slide element 22 relative to the connecting element 24 can take place in as play-free a manner as possible. One essential difference compared to the embodiment shown in FIG. 2 is that the bearing holes 90 are each opened radially above a slot 92 which runs from the bearing hole 90 towards the lower edge of the leg 34, that is to say the edge opposite the back 32 of the connecting element 24. The slot 92 expands from the edge of the bearing hole 90 towards the edge of the leg 34. The narrow point of the slot 92 is in this case narrower than the diameter of the respective bearing pin 88. Upon assembly or disassembly of the slide element 22 and

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the connecting element 24, the bearing pins 88 are pressed radially into the bearing holes 90 or out of the latter through the slots 92 in the manner of a locking connection, negotiating the narrow point. As a result, these processes are considerably simplified, and moreover a sufficiently reliable seating or holding of the bearing pins 88 in the bearing holes 90 is ensured.

Usually, the connection of a wiper blade 12 provided with such a slide element 22 and such a connecting element 24 to a wiper arm 14 or to the coupling section 26 of a wiper arm 14, and removal thereof in the opposite direction, take place in the same general manner, as has been described in connection with FIGS. 1 to 6. However, in the embodiment shown in FIG. 11, there is also the possibility firstly of attaching the connecting element 24, separated from the wiper blade 12, in this general way to the coupling section 26 of the wiper arm 14 and then mounting the slide element 22 connected to the wiper blade 12 on the connecting element 24 by pushing the bearing pins 88 radially through the slots 92 into the bearing holes 90. It is also conceivable to carry out a disassembly operation by reversing the sequence of these last-mentioned steps.

Devices for releasably connecting a wiper blade to a wiper arm which correspond to the examples of embodiments shown in FIGS. 1 to 10 are suitable in particular for use in wiper systems for front windcreens of vehicles, whereas the device corresponding to the example of embodiment shown in FIG. 11 is suitable in particular for use in wiper systems for rear windows of vehicles.

All of the features found in the description, the drawings and the claims may be essential to the invention both individually and in any desired combination with one another.

The invention claimed is:

1. A wiper blade assembly to be connected to an end portion of a wiper arm, said wiper blade assembly comprising:

a wiper strip intended to wipe a windscreen;
an elongate support element supporting said wiper strip along said wiper strip;

a blade support element connected to said elongate support element over only a portion of said elongate support element, wherein said wiper strip is connected to said elongate support element over said portion of said elongate support element that is connected to said blade support element;

a connecting element pivotably mounted on the blade support element;

wherein said connecting element defines a receiving portion shaped to receive a first part of the end portion of the wiper arm at a first location on the connecting element, and a securing portion shaped to secure a second part of the end portion of the wiper arm to the connecting element at a second location on the connecting element,

wherein the connecting element is configured such that, in a preassembly position when the receiving portion first receives said first part of the end portion of the wiper arm, the connecting element and the end portion of the wiper arm form an oblique angle at said first location, and

wherein the connecting element is further configured such that, after the first part of the end portion of the wiper arm is received by the receiving portion, the end portion of the wiper arm and the connecting element can pivot with respect to each other about the first location until said securing portion secures the second part of the end portion of the wiper arm.

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2. A wiper blade assembly according to claim 1, wherein one of said receiving portion or said securing portion includes a pair of lateral members extending on lateral side walls of said connecting element.

3. A wiper blade assembly according to claim 1, wherein said connecting element includes a pair of lateral members extending on lateral side walls of said connecting element.

4. A wiper blade assembly according to claim 1, wherein the connecting element is pivotably mounted on the blade support element about a pivot, and wherein said connecting element has a front portion on a front side of the connecting element relative to said pivot and a rear portion on a rear side of the connecting element relative to said pivot, said front portion including said receiving portion.

5. A wiper blade assembly according to claim 4, wherein said receiving portion includes an opening in an outer top surface of said front portion, and wherein said rear portion includes said securing portion.

6. A wiper blade assembly according to claim 1, wherein said securing portion includes a pair of flexible members.

7. A wiper blade assembly according to claim 1, wherein the connecting element is pivotably mounted on the blade support element about a pivot, and

wherein said connecting element has a front portion on a front side relative to said pivot and a rear portion on a rear side relative to said pivot,

wherein said connecting element has a mid-portion extending over said pivot and between said front and rear portions, said mid-portion extending between lateral sides of said mid-portion which extends over said pivot, and

wherein said front portion has an outer top surface that is raised relative to said mid-portion which extends over said pivot.

8. A wiper blade assembly according to claim 7, wherein said front portion of said connecting element has lateral sides that are wider apart than said lateral sides of said mid-portion.

9. A wiper blade assembly according to claim 8, wherein said rear portion of said connecting element includes a pair of members, each member being on a respective lateral side of said rear portion, wherein said members are wider apart than said lateral sides of said mid-portion.

10. A wiper blade assembly comprising:

a wiper blade; and

a connector coupled to said wiper blade such that said connector and said wiper blade pivot relative to each other about a pivot, said pivot having a pivot axis extending through lateral side walls of said connector in a direction transverse to a longitudinal axis of said wiper blade;

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wherein said connector has a front portion on a front side of the connector relative to the pivot and a rear portion on a rear side of the connector relative to said pivot, said front portion defining part of an opening on an outer top surface of said front portion, and said rear portion having a pair of receiving members, each receiving member being on a respective lateral side of said rear portion, wherein said connector has a mid-portion extending over said pivot and between said front and rear portions, said mid-portion extending between lateral sides of said mid-portion,

wherein said outer top surface of said front portion is raised relative to said mid-portion which extends over said pivot, and

wherein said front portion has lateral sides that are wider apart than said lateral sides of said mid-portion which extends over said pivot.

11. A wiper blade assembly according to claim 10, wherein said receiving members are wider apart than said lateral sides of said mid-portion.

12. A wiper blade assembly according to claim 10, wherein said mid-portion defines another part of said opening on a side next to said front portion such that said opening extends from said mid-portion to said front portion.

13. A wiper blade assembly according to claim 10, wherein said front portion has an inner top surface and a protrusion extending from said inner top surface such that a tip of said protrusion extends below a level corresponding to an outer top surface of said mid-portion.

14. A wiper blade assembly according to claim 10, wherein said receiving members extend below a level corresponding to an outer top surface of said mid-portion.

15. A wiper blade assembly according to claim 10, wherein said wiper blade has an elongate wiper strip on a bottom side of the wiper blade and an elongate support element on a top side of the wiper blade, and wherein said connector is coupled to said wiper blade via an intermediate element secured to a portion of the elongate support element of the wiper blade.

16. A wiper assembly comprising a wiper arm and the wiper blade assembly according to claim 1, wherein said wiper arm comprises an end, and wherein said connecting element is connected to the end portion of said wiper arm.

17. A wiper assembly comprising a wiper arm and the wiper blade assembly according to claim 10, wherein said wiper arm comprises an end with a protrusion, said protrusion being received in said opening.

* * * * *

Exhibit B



US008220106B2

(12) **United States Patent**
Fink et al.

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(45) **Date of Patent:** **Jul. 17, 2012**

(54) **DEVICE FOR DETACHABLY LINKING A WIPER BLADE WITH A DRIVEN WIPER ARM**

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(30) **Foreign Application Priority Data**

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B60S 1/40 (2006.01)

(52) **U.S. Cl.** **15/250.32; 15/250.351; 15/250.43**

(58) **Field of Classification Search** **15/250.32, 15/250.43, 250.44, 250.351, 250.46, 250.201, 15/250.361**

See application file for complete search history.

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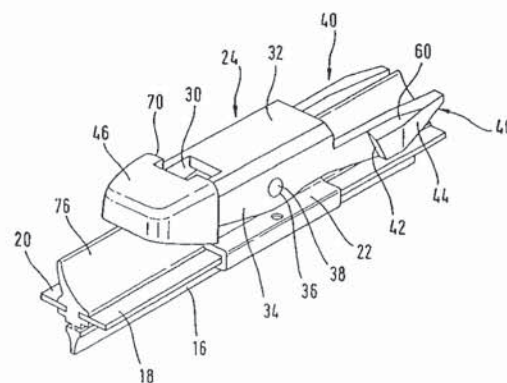
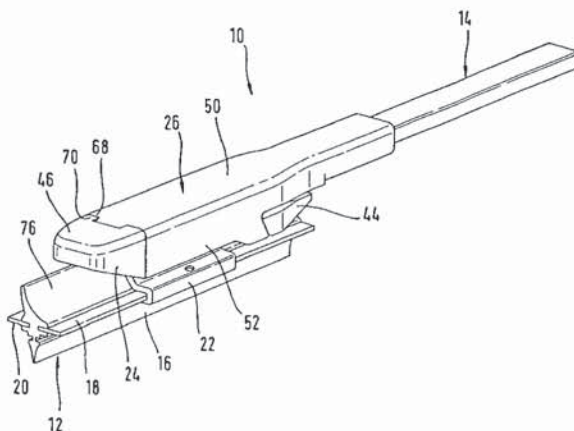
Primary Examiner — Gary Graham

(74) *Attorney, Agent, or Firm* — Oblon, Spivak, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

A wiper blade assembly for a windshield wiper. In one embodiment, the wiper blade assembly includes a connector mounted on a blade support element. The connector has a receiving portion shaped to receive a first part of the end portion of a wiper arm and further has a securing portion shaped to secure a second part of the end portion of the wiper arm.

19 Claims, 6 Drawing Sheets



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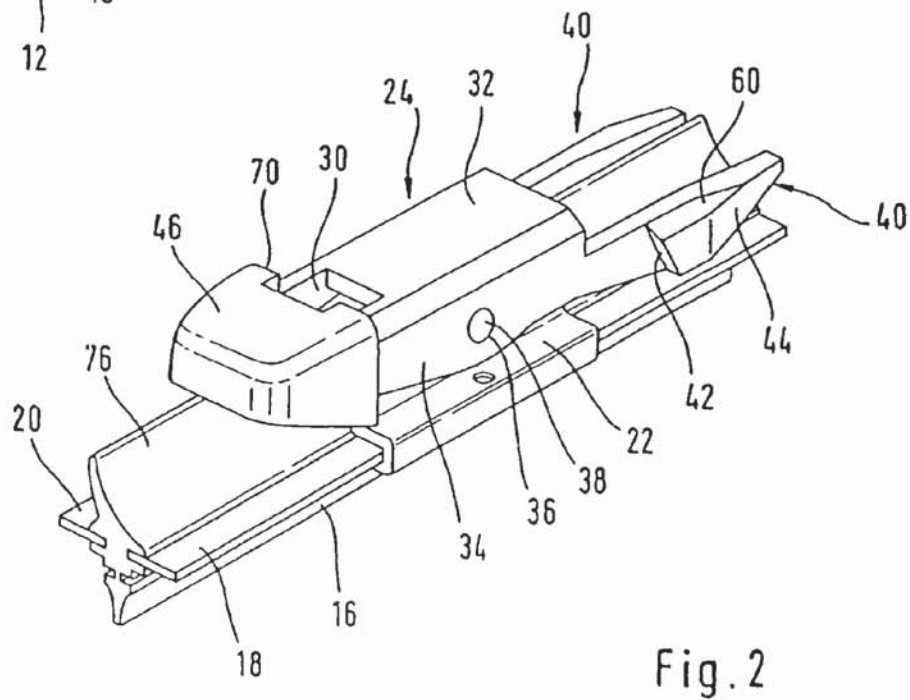
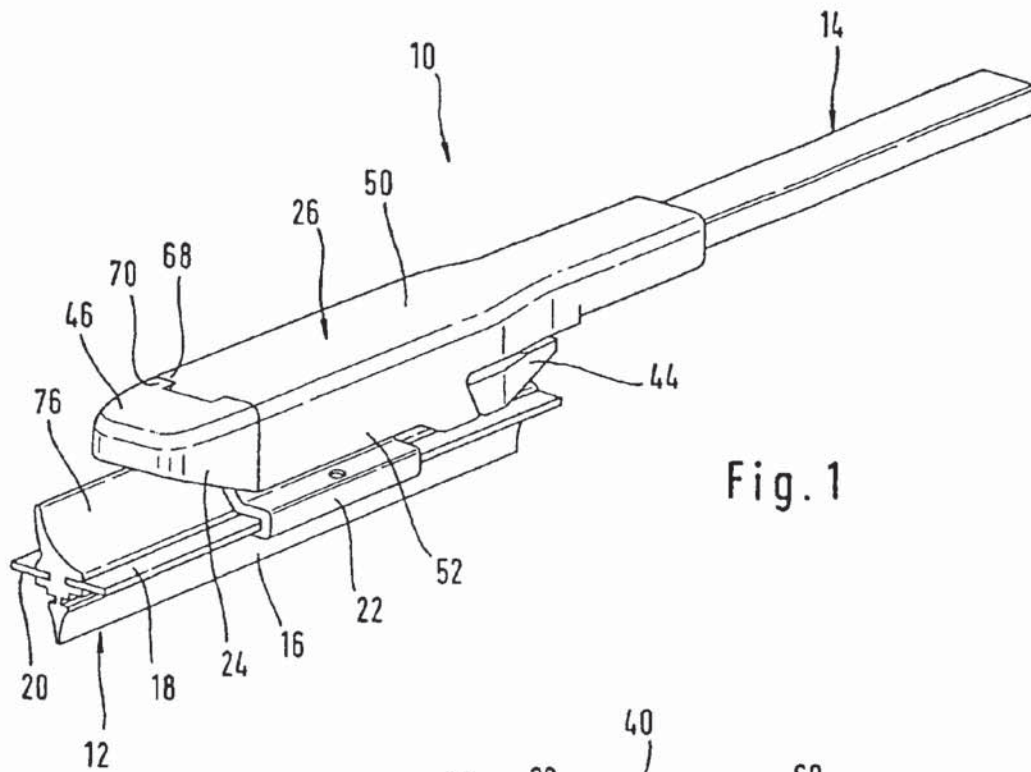


Fig. 3

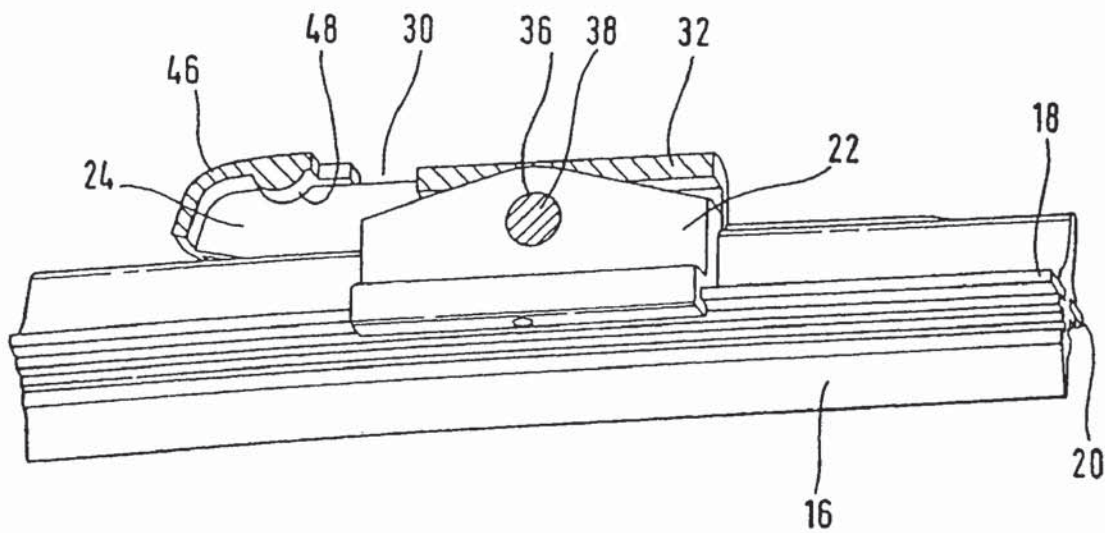
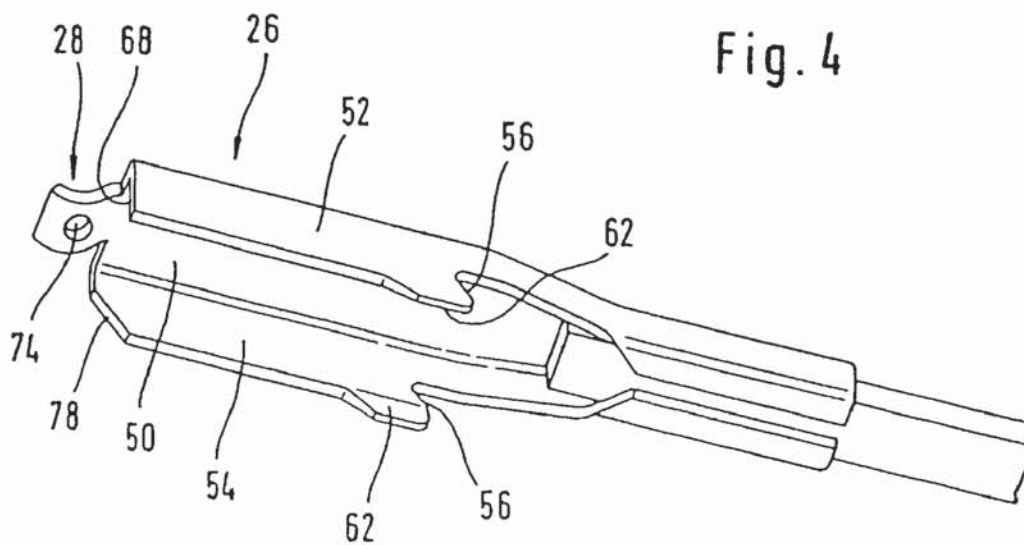


Fig. 4



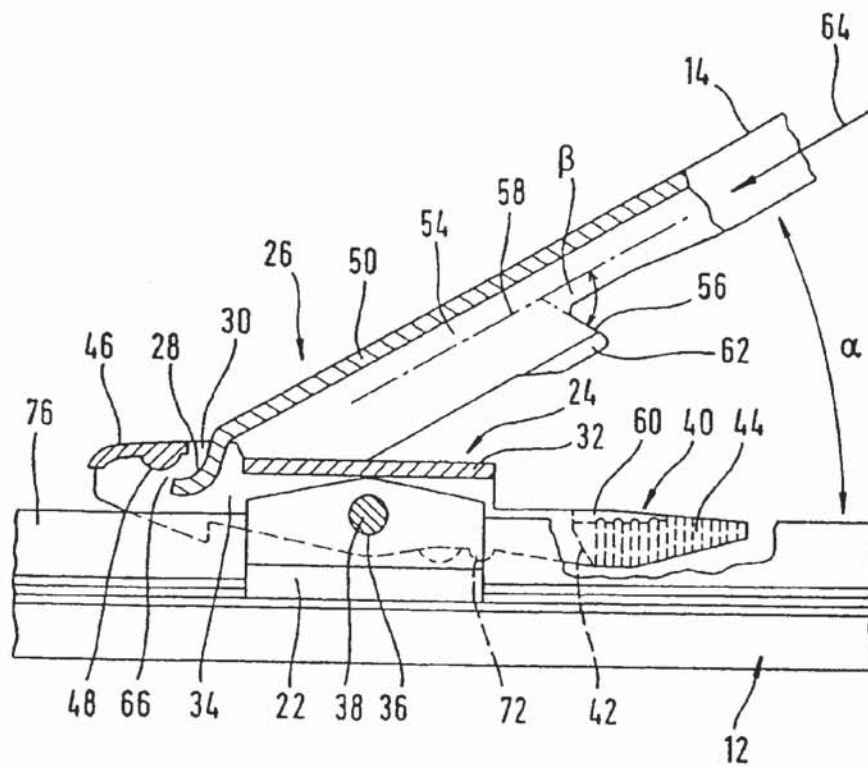


Fig. 5

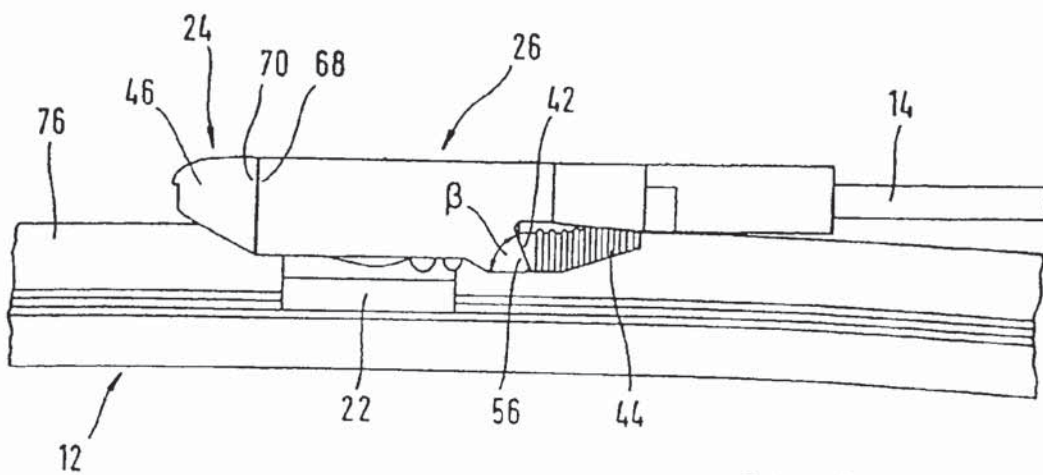
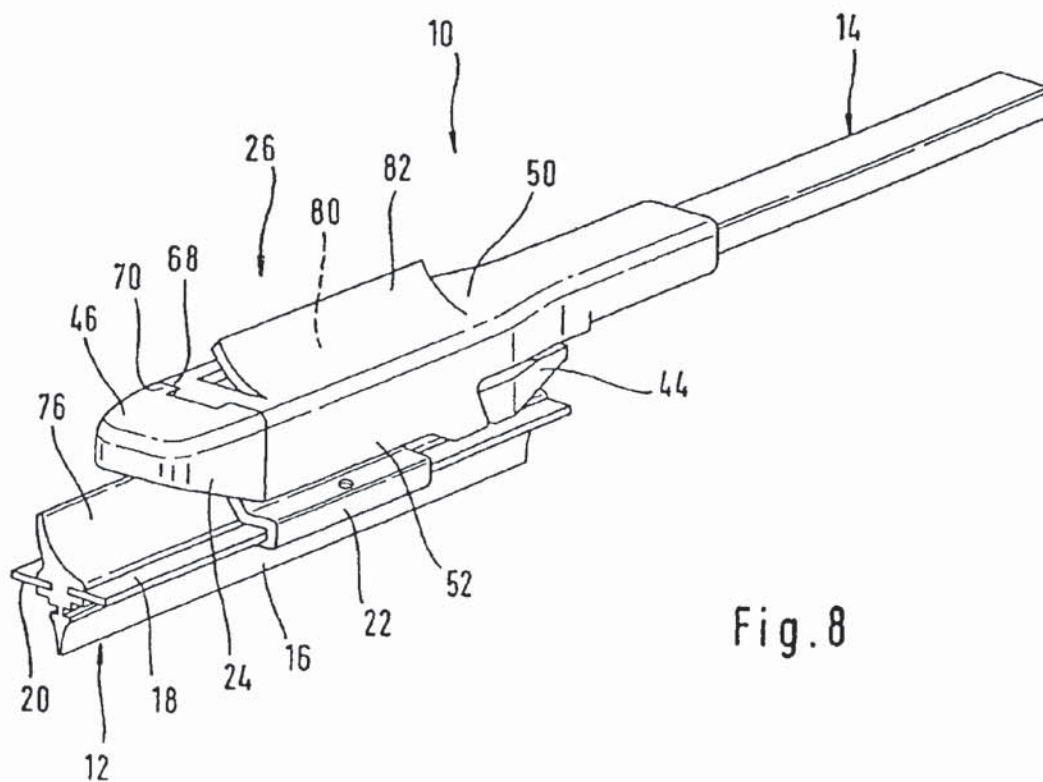
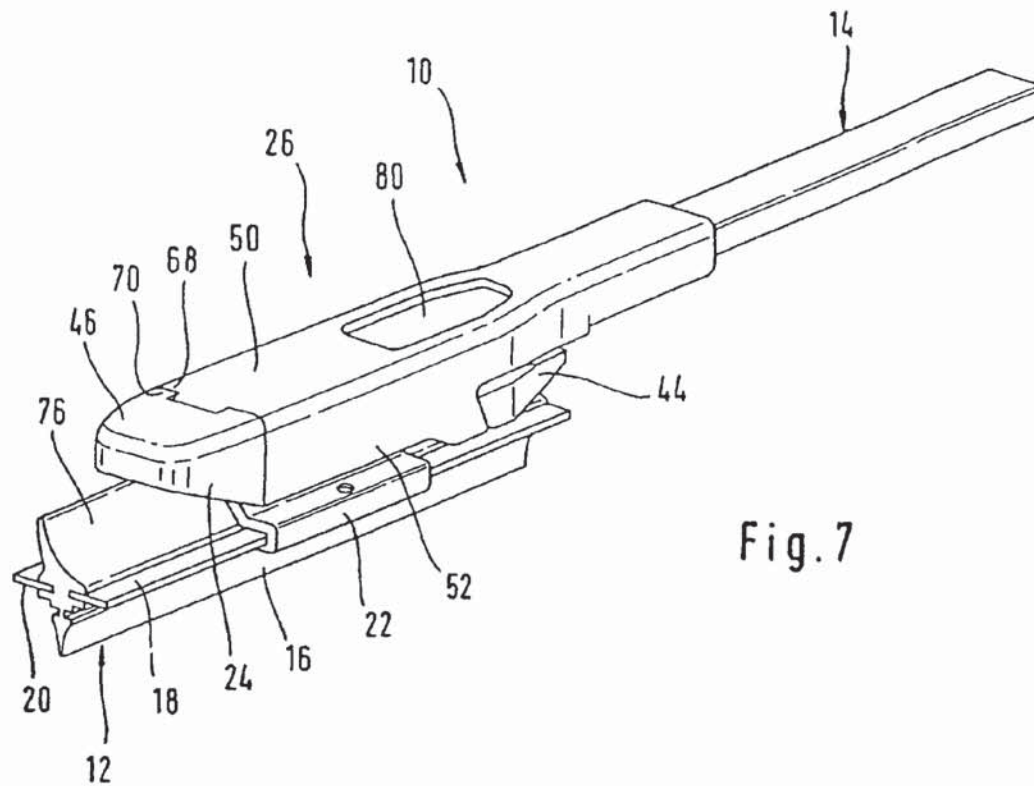


Fig. 6



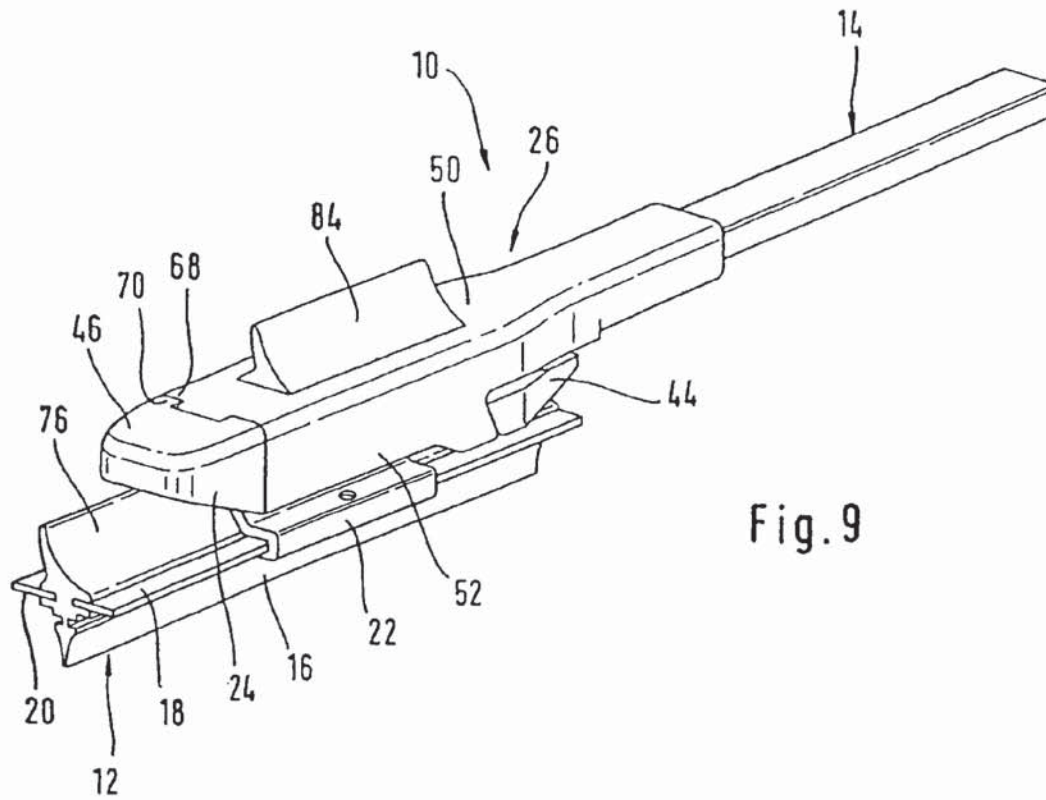


Fig. 9

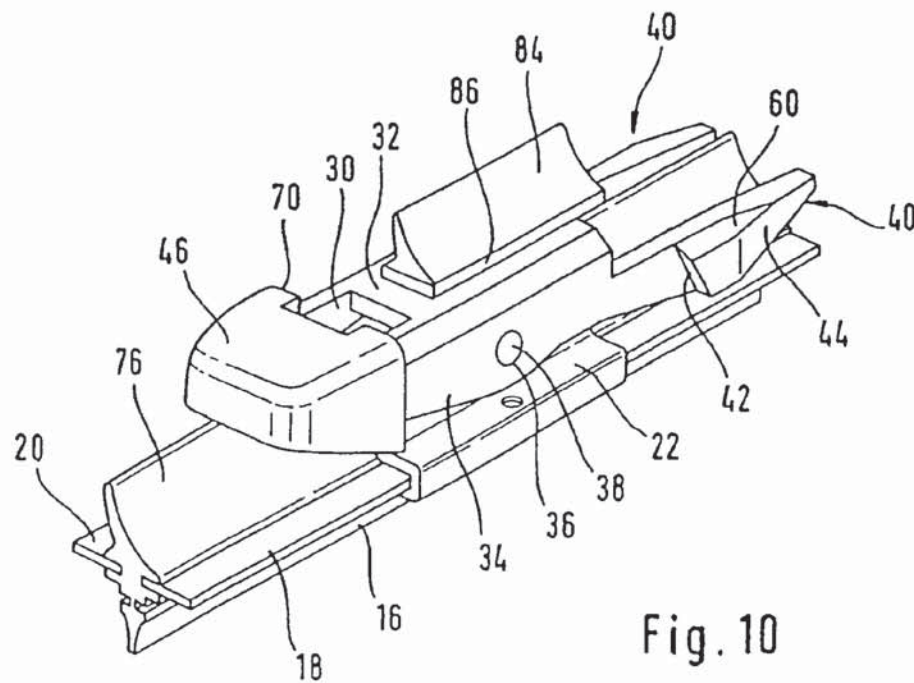


Fig. 10

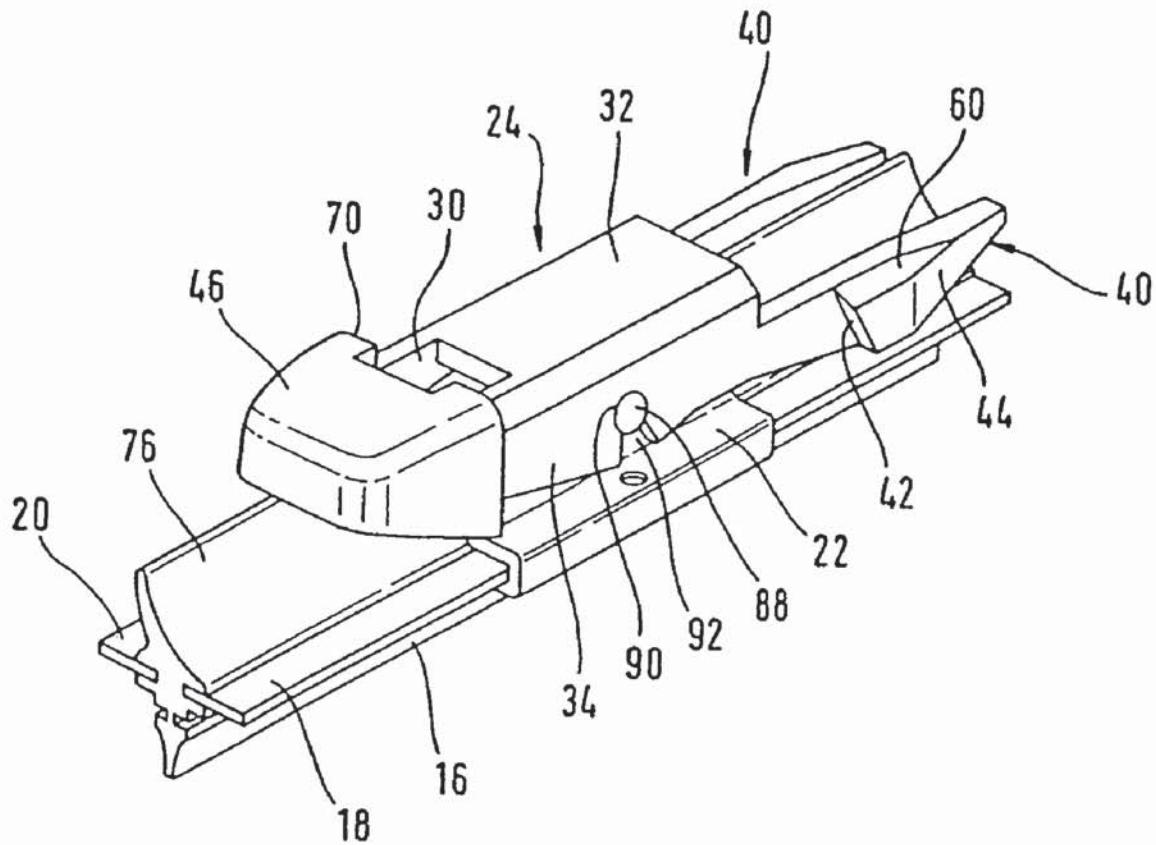


Fig. 11

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DEVICE FOR DETACHABLY LINKING A WIPER BLADE WITH A DRIVEN WIPER ARM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of pending U.S. application Ser. No. 10/536,054 filed Jan. 19, 2006, which is herein incorporated in its entirety by reference. U.S. application Ser. No. 10/536,054 is the National Stage application of PCT International Application No. PCT/EP2003/013062 filed Nov. 21, 2003, which claims the benefit of priority from German Patent Application Nos. 102 54 978.8 filed Nov. 26, 2002 and 103 23 997.9 filed May 27, 2003.

The invention relates to a device and a method for releasably connecting a wiper blade to a drivable wiper arm, wherein the wiper blade comprises a wiper strip which faces the windscreen to be wiped, at least one strip-like elongate support element, a slide element which is connected to the support element, and a connecting element for connection to a coupling section of the wiper arm, which connecting element is mounted on the slide element in a manner such that it can pivot.

Such a device is known for example from WO 02/40328 A1. The device described therein, by means of which a flat wiper blade can be connected to the coupling section, has a large number of complex components which are difficult to manufacture. Moreover, the operation of connecting the coupling section of the wiper arm to the connecting element of the wiper blade is relatively complex and requires a certain amount of skill.

It is therefore an object of the present invention to propose a device for releasably connecting a wiper blade to a drivable wiper arm, in which the operation of connecting the connecting element to the coupling section can be carried out in a simple manner. Moreover, it is to be ensured that the coupling section is joined in a permanently secure manner to the connecting section, wherein the wiper blade can nevertheless be released from the wiper arm in a simple manner.

According to the invention, this object is achieved by a device of the type described above in that the coupling section has a tongue-like insertion section, in that the connecting element has a seat for the insertion section, and in that the coupling section and the connecting element have securing sections for providing a mutual permanent connection, wherein, in order to reach a preassembly position in which the longitudinal axis of the wiper arm and the longitudinal axis of the connecting element enclose an angle α in the range from approximately 10° to 100° , the insertion section can be inserted in a substantially rectilinear manner into the seat, and wherein, in order to reach a final assembly position, the wiper arm and the connecting section can be pivoted onto one another about the insertion section/seat contact area until the securing sections allow a permanent mutual connection.

The invention has the advantage that only two steps which are simple to carry out are required in order to connect the wiper blade to the wiper arm, namely firstly rectilinear insertion of the insertion section into the seat provided on the connecting element, and pivoting of the coupling section or of the wiper arm and of the connecting element onto one another.

Moreover, such a device has the advantage that it is of a very flat and very narrow design. On the one hand, wind noise is minimized as a result. On the other hand, the view of the vehicle driver is only slightly impaired by the wiper blade and the wiper arm. Furthermore, force introduction preferably

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takes place over the longitudinal axis of the wiper blade, substantially perpendicular to the windscreen to be wiped, and as a result the occurrence of tilting moments is suppressed.

5 Preferably, the insertion direction for reaching the preassembly position lies in the plane of pivoting for reaching the final assembly position. This has the advantage that the two movements lie in one plane, and as a result the assembly operation is simplified.

10 One embodiment of the invention is characterized in that the coupling section is designed to be U-shaped in cross section and comprises a back and two legs, wherein the insertion section is designed in a hook-like manner and is arranged in a stand-alone manner on the back of the coupling section.

15 The coupling section, which is designed to be U-shaped in cross section, advantageously engages over the connecting element at least in part in the final assembly position. As a result, transverse forces acting on the connecting element can be absorbed by the legs of the coupling section.

20 The insertion section is preferably designed such that it is arc-shaped at the free end, in the direction of the extension of the wiper arm and in side view in the direction of the windscreen to be wiped, in such a manner that it does not protrude beyond the back. This has the advantage that the insertion section, in the final assembly position, does not protrude in a disruptive manner beyond the back of the coupling section. Given a suitably designed connecting element, the insertion section is not visible in the final assembly position.

It is advantageous if the region of the connecting element which cooperates with the insertion section and adjoins the insertion opening is designed to be complementary to the insertion section. In this way it can be ensured, in the final assembly position, that the insertion section bears reliably against the complementarily designed region of the connecting element.

30 A further embodiment of the invention is obtained when the region of the connecting element and of the insertion section which cooperates with the insertion section is designed to be arc-shaped, and in particular shaped like a segment of a circle, in longitudinal section. When the coupling section and the connecting element are pivoted onto one another in the final assembly position, this ensures that during the pivoting movement the insertion section bears with a substantial part of its surface against the region of the connecting element which cooperates with the insertion section. This ensures reliable guidance when assembling the device from the preassembly position to the final assembly position. Stress peaks are avoided on account of the large-surface bearing.

35 One further embodiment is obtained when the connecting element is designed to be U-shaped in cross section and comprises a back and two legs. On account of the U-shaped design of the connecting element, a spoiler section of the wiper strip which faces away from the windscreen to be wiped can extend between the two legs of the connecting element in the longitudinal direction of the wiper blade. Furthermore, the connecting element can advantageously be coupled at the legs to the slide.

Advantageously, the insertion opening is designed as a cut-out on the back. This has the advantage that the insertion opening can be clearly seen on the wiper blade in plan view, as a result of which insertion of the insertion section into the insertion opening is simplified.

40 According to the invention, it is furthermore conceivable that, in the final assembly position, the coupling section covers the connecting element at least in part. In the state mounted on the wiper arm, the inner sides of the legs of the

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U-shaped coupling section then preferably bear against the outer sides of the legs of the U-shaped connecting element. The outer side of the back of the connecting element preferably bears against the inner side of the back of the coupling section.

A further advantageous embodiment of the invention is obtained when the securing sections are designed as locking sections. When the coupling section and the connecting element are pivoted onto one another, the locking sections advantageously lock with one another in the final assembly position.

It may be provided that the connecting element has, on its side facing away from the insertion opening in the longitudinal direction, on the legs, in each case a locking tongue which extends in the longitudinal direction and is elastically flexible in the transverse direction, which locking tongues cooperate with locking edges provided on the legs of the coupling section.

In order to ensure secure locking, it may advantageously be provided that the locking edges of the locking tongues and the locking edges of the legs enclose an acute angle, in particular an angle in the range from approximately 30° to 80°, with the longitudinal axis of the wiper blade in the final assembly position.

In order to release the locking connection, and thus to release the wiper blade from the wiper arm, in a further embodiment of the invention it may be provided that actuating sections are provided on the free ends of the locking tongues. The actuating sections are designed in such a way that the locking tongues can be pressed towards one another, as a result of which the locking edges of the locking tongues can come out of engagement with the locking edges on the legs of the coupling section.

In order to allow easier locking, it is advantageously provided that the sides of the locking tongues which face the back of the coupling section and meet the legs of the coupling section when pivoted into the final assembly position are bevelled.

Easier locking is also assisted if the sides of the legs of the coupling section which face the windscreen and which are met by the facing sides of the locking sections when pivoted into the final assembly position are bevelled. Shortly prior to reaching the final assembly position, the bevelled sides of the locking tongues consequently cooperate with the bevelled sides of the legs of the coupling section in such a way that the locking tongues are pivoted out in directions towards one another. In the final assembly position, the locking tongues snap behind the locking edges of the coupling section in directions facing away from one another.

In order to prevent a wiper blade from being arranged the wrong way round on a wiper arm, the coupling section may have a suitable coding. Incorrect assembly of the wiper blade, for example on the incorrect wiper arm, is thus prevented. A coding may be produced for example by a suitable bezel on the coupling section and by a suitable web on the connecting element which cooperates with the bezel.

A further advantageous embodiment of the invention is obtained when the legs of the connecting element are designed as double-walled legs which are slightly elastically flexible in the transverse direction. Such double-walled legs have a better friction behaviour with respect to the slide element against which they are pivotably arranged. Advantageously, the connecting element has, between the legs, a hinge pin which is mounted in a hole on the slide element for the pivotable arrangement of the connecting element.

Another embodiment of the invention provides that the slide element has a bearing bolt or alternatively two hinge

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pins which project with their ends from the slide element and on which the connecting element is pivotably mounted by bearing holes in its legs, which bearing holes are designed in a corresponding manner and are arranged so as to be aligned.

In this case, the bearing bolt is or the bearing pins are connected fixedly against rotation to the slide element, and the connecting element is mounted on the slide element in a manner such that it can rotate or pivot. When a wiper blade is replaced, therefore, the entire bearing device is exchanged.

According to a further embodiment of the invention, the bearing holes provided in the legs of the connecting element are opened above in each case a slot towards the edge, which slot runs radially with respect to the bearing hole. This may advantageously be used to simplify the assembly of the individual parts.

According to another embodiment, if the slot in each case runs from the bearing hole to the edge of the leg which lies opposite the back of the connecting element, the risk of the bearing bolt or bearing pin undesirably sliding out of the bearing hole is small.

One further advantageous embodiment provides that in each case the slot expands from the bearing hole towards the edge of the leg, wherein the narrowest point of the slot is smaller than the diameter of the bearing bolt or the alternative bearing pins. This embodiment allows simplification of assembly and disassembly. The bearing bolt or bearing pins can be pressed in radially through the slot in the manner of a locking connection, negotiating the narrow point. Likewise, the bearing bolt or bearing pins can also be removed in the opposite direction, again negotiating the narrow point. To this end, it may be necessary for the connecting element to be made of a suitable plastics material which allows the narrow point of the slot to be negotiated by the bearing bolt or bearing pins. The slide element and/or the bearing bolt or the bearing pins may be made of metal or likewise made of a suitable plastics material.

A further, advantageous embodiment of the invention provides that the legs of the connecting element have stud-like raised areas on the side facing the windscreen. These raised areas serve for support on either the wiper rubber or the support element, as a result of which easier assembly and disassembly of the wiper blade is made possible.

The coupling section and the connecting element are preferably designed in such a way that, in the final assembly position, they have a substantially closed and substantially smooth surface. To this end, the sections of the connecting element which are covered by the coupling section may lie deeper than the sections of the connecting element which are visible in the final assembly position, the difference in depth being the wall thickness of the coupling section.

Further advantageous refinements are provided in order to improve the aerodynamic behaviour of the wiper arm/wiper blade combination, particularly at high travelling speeds or airflow velocities, and thus to counteract in particular the known effect of lifting of the wiper blade connected to the wiper arm off the windscreen to be wiped.

By virtue of the measure that the coupling section of the wiper arm has at least one opening suitable for air to flow through, a dynamic pressure which arises below the U-shape of the coupling section is substantially broken down. As a result, the lifting force on the wiper arm is reduced.

It is particularly advantageous to provide the at least one opening in the back of the coupling section. However, an improvement is also possible if one or more airflow openings are placed in the legs of the coupling section, in particular in the lee-side leg. The maximum effect can probably be achieved by a combination of the individual possibilities.

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Another embodiment provides that at least one spoiler-like air guide means is provided on the coupling section of the wiper arm. In this way, the incoming air can be guided in such a way that the effect of the wiper blade or wiper arm being lifted off the windscreen is counteracted. It is advantageous in this connection for the at least one air guide means to be arranged on the back of the coupling section. A spoiler acts particularly effectively at this location.

The advantages of an embodiment, according to which the air guide means is formed by a section cut free from the back of the coupling section and bent upwards in a spoiler-like manner, are to be seen in the combination of the effects of the spoiler and of the airflow opening formed in this way. The pressing force is thus directly increased and at the same time the dynamic pressure inside the coupling section is reduced. Moreover, an air guide means produced in this way is particularly cost-effective.

A further advantageous embodiment provides that at least one spoiler-like air guide means which is preferably made in one piece with the connecting element is arranged on the back of the connecting element, and that this at least one air guide means protrudes through a, preferably corresponding, opening in the back of the coupling section. Since the connecting element is advantageously made of plastics material, a very large number of design possibilities are provided for the shape of the spoiler-like air guide means with regard to particularly favourable fluidic properties.

The object mentioned in the introduction is also achieved by a method of assembling a device according to the invention, which method is characterized in that, in order to reach a preassembly position in which the longitudinal axis of the wiper arm and the longitudinal axis of the connecting element enclose an angle α in the range from approximately 10° to 100° , the insertion section is inserted in a substantially rectilinear manner into the seat, and in that, in order to reach a final assembly position, the wiper arm and the connecting section can be pivoted onto one another about the insertion section/seat contact area until the securing sections enter into a permanent mutual connection.

Further details and advantages of the invention can be found in the following description in which the invention is described and explained in more detail with reference to examples of embodiments shown in the drawings.

In the drawings:

FIG. 1 shows a device according to the invention in a perspective view;

FIG. 2 shows the device of FIG. 1 without the wiper arm;

FIG. 3 shows a partial section through FIG. 2;

FIG. 4 shows a view from below of the coupling section shown in FIG. 1;

FIG. 5 shows a partial section through the device of FIG. 1 in a preassembly position;

FIG. 6 shows a partial section through the device of FIG. 5 in the final assembly position;

FIG. 7 shows another embodiment of a device according to the invention in a perspective view;

FIG. 8 shows a further embodiment of a device according to the invention in a perspective view;

FIG. 9 shows a final embodiment of a device according to the invention in a perspective view;

FIG. 10 shows the device of FIG. 9 without the wiper arm; and

FIG. 11 shows another embodiment of a device according to the invention without the wiper arm.

FIG. 1 shows a device 10 according to the invention for releasably connecting a wiper blade 12, shown in part, to a drivable wiper arm 14 which is likewise shown in part. The

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wiper blade 12 has a wiper strip 16 which faces the windscreen to be wiped (not shown) and comprises two strip-like elongate support elements 18, 20, a slide element 22 which is connected to the support elements 18, 20, and a connecting element 24 which is arranged on the slide element 22 in a manner such that it can pivot. The connecting element 24 serves for connection to a coupling section 26 on the wiper arm 14.

The coupling section 26 has, as can be seen in particular in FIG. 4, a tongue-like insertion section 28 which, in the final assembly position shown in FIGS. 1 and 6, engages in a seat 30 which can be clearly seen in FIG. 2. The connecting element 24, which like the coupling section 26 is U-shaped in cross section, has a back 32 and two legs 34. The seat 30 is provided in the back 32 of the connecting element 24. A bearing hole 36 for a bearing bolt 38, which bearing hole extends in the transverse direction, is provided on the legs 34 of the connecting element 24. On account of the bearing hole 36, and the bearing bolt 38, a pivoting arrangement of the connecting element 24 with respect to the slide element 22 is obtained. In order to achieve a certain flexibility of the legs 34 while having sufficient stiffness, the legs 34 are designed to be double-walled.

As can likewise be seen from FIG. 2, the connecting element 24 has, on a rear portion on its rear side facing away from the insertion opening 30 in the longitudinal direction, on the legs 34, in each case a locking tongue 40 which extends in the longitudinal direction and is elastically flexible in the transverse direction. The locking tongues 40 each comprise a locking edge 42 and an actuating section 44. The region of the connecting element 24 which is covered by the coupling section 26 in the final assembly position is set back from the other regions of the connecting element 24 which are formed essentially by the two actuating sections 44 and a head section 46 which lies within a front portion of the connecting element on a front side relative to the pivot 36/38 in the axial extension of the coupling section, the front of the back 32 also extending into this front portion. As a result, in the final assembly position, the coupling section 26 and the connecting element 24 form a substantially closed and substantially smooth surface. As seen in FIG. 2, the head section 46 defines a first U-shaped indentation, and the front of the back 32 defines the seat 30 in the shape of a second U-shaped indentation facing the first U-shaped indentation. As shown in FIG. 2, the branches of the first U-shaped indentation extend from a base toward the pivoting arrangement 36/38, while the branches of the second U-shaped indentation extend from a base away from the pivoting arrangement 36/38.

As can be seen from FIG. 3, the region 48 which cooperates with the insertion section 28 and adjoins the insertion opening 30 is designed to be complementary to the insertion section 28. As can be seen from FIGS. 4 and 5, the insertion section 28 is designed in an arc-shaped manner in the direction of the extension of the wiper arm 14 and in side view in the direction of the windscreen to be wiped. Correspondingly, as can be seen from FIGS. 3 and 5, the region 48 is likewise designed to be arc-shaped, in particular in the shape of a segment of a circle.

It can be seen from FIG. 4 that the coupling section is designed in a U-shaped manner in cross section and has a back 50 and legs 52, 54 which adjoin the back. The insertion section 28 is in this case arranged in a stand-alone manner in the extension of the back 50. Provided on the legs 52, 54 are locking edges 56 which enclose an angle β of approximately 70° with the longitudinal axis 58 of the wiper arm 14 (FIGS. 5 and 6). The locking edges 42 of the locking tongues 40 enclose a corresponding angle β . In the final assembly posi-

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tion shown in FIG. 6, the locking edges 42 of the locking tongues 40 bear against the locking edges 56 of the legs 52, 54 of the coupling section 26.

It can be seen from FIGS. 2 and 5 that the sides 60 of the locking tongues 40 which face the back 50 of the coupling section 26 are slightly bevelled. In a corresponding manner, the sides 62 of the legs of the coupling section 26 which face the windscreen and cooperate with the sides 60 of the coupling section 26 when pivoted into the final assembly position are also slightly bevelled.

For assembly of the coupling section 26 to the connecting element 24, in order to reach a preassembly position which is shown in FIG. 5, the insertion section 28 is inserted into the seat 30 in a substantially rectilinear manner in the direction of the arrow 64. In this preassembly position, the longitudinal axis of the wiper arm 14 and the longitudinal axis of the connecting element 24 or of the wiper blade 12 enclose an angle α which may lie in the range from approximately 10 to 100°. In the example of embodiment shown in FIG. 5, the angle α has a value of approximately 40°. In order to reach the final assembly position, which is shown in FIG. 1 and FIG. 6, the wiper arm 14 and the connecting section 24 are pivoted onto one another about the contact area 66 in which the insertion section 28 bears against the region 48 of the seat 30. On account of the complementary design of the insertion section 28 and the region 48, the pivoting operation is carried out to a limited extent. Shortly prior to reaching the final assembly position, the bevelled sides 62 of the coupling section 26 and the correspondingly bevelled sides 60 of the locking tongues 40 meet one another in such a way that the locking tongues 40 are pivoted elastically in a direction facing one another. Upon reaching the final assembly position, the locking tongues 40 snap behind the locking edges 56 of the legs 52, 54 of the coupling section 26 in a direction facing away from one another. As a result, the coupling section 26 is permanently held on the connecting element 24 in the final assembly position. In the final assembly position, the coupling section 28 bears against the region 48 of the connecting element 24 over a large part of its surface. Furthermore, the end side 68 of the coupling section 26 which faces the head area 46 of the connecting element 26 bears against a bearing edge 70 of the connecting element which corresponds thereto.

On account of the locking edges 42, 56 which are not perpendicular to the longitudinal axis of the wiper blade but rather enclose an acute angle β with the longitudinal axis, in the assembled state the coupling section 26 is acted upon in the direction of the head section 46. As a result, a play-free connection is obtained in the axial direction. Moreover, by virtue of the obliquely arranged locking edges 42, 56, the coupling section 26 is acted upon in the direction of the wiper blade 12, as a result of which a play-free connection is produced in the direction perpendicular to the wiper blade. The insertion section 28 in this case bears against the contact region 48 of the connecting element 24 with slight prestress.

In order to release the connection, the actuating sections 44 are pressed towards one another. As a result, the locking edges 42 of the locking tongues 40 come out of the engagement region of the locking edges 56 of the coupling section 26. Since the actuating sections are arranged opposite one another, the actuating sections 44 can be pressed together by a simple hand grip, using one hand. The coupling section 26 is then pivoted away from the connecting element 24 until the preassembly position reached in FIG. 5 is almost reached. The insertion section 28 is then moved out of the seat 30 in the direction counter to the arrow 64.

As can be clearly seen in FIG. 5, it may be provided that the legs 34 of the connecting element have stub-like raised areas

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72 on the side facing the windscreen. These raised areas serve for support on the slide element 22. The raised areas 22 restrict the pivoting range of the connecting element 24 with respect to the slide element 22. As a result, easier assembly and disassembly of the wiper blade 12 from the wiper arm 14 is possible.

In the bent region of the insertion section 28, a material cut-out in the form of a cylindrical hole 74 is provided.

In order to prevent it from being possible for the wiper blade, which has a spoiler-like projection 76 on its side facing away from the wiper strip 16, to be mounted on the incorrect wiper arm, a coding may be provided on the connecting element 24 and on the coupling section 26. Such a coding may be formed for example by a bevelled corner 78 on the leg 54 of the coupling section 26, as shown in a corresponding manner in FIG. 4. The bevelled corner 78 may in this case correspond to a material deposit at the corresponding location on the connecting element 24, which material deposit is designed in a complementary manner and is not shown in the figures. Since only one of two wiper blades, the respective right-hand or left-hand wiper blade, has a corresponding material deposit on the connecting element, a clear assignment of the right-hand or left-hand wiper blade to the right-hand or left-hand wiper arm is ensured.

For the example of embodiment shown in FIG. 7, in general the same description as above in respect of the first example of embodiment shown in FIGS. 1 to 6 applies. The same references have thus been used in FIG. 7 as in FIG. 1.

The essential difference of the example of embodiment shown in FIG. 7 is that an opening 80 is additionally provided in the back 50 of the coupling section 26 belonging to the wiper arm 14. This opening 80 makes it possible for air flowing below the U-shape of the coupling section to leave the space formed below the U-shape on a relatively short path by flowing through the opening 80. In this way, the dynamic pressure below the coupling section 26 is reduced compared to an embodiment without the opening 80, and this leads to a comparative reduction in the lifting force of the wiper arm 14 as air flows through.

Instead of the one opening 80, it would also be possible for a number of openings 80 to be provided in the coupling section 26, wherein one or more openings 80 may also be made in one of the two legs 52, 54 or in both legs 52, 54. The size, shape and position of the one or more openings 80 should be optimized with regard to as considerable an effect as possible in a manner depending on the geometric conditions of the individual components of the device 10 and of the device 10 as a whole. Likewise, the shape and size of the one or more openings 80 may be adapted to the design of the coupling section 26.

Also for the further example of embodiment shown in FIG. 8, the same description as that given above in respect of the first example of embodiment shown in FIGS. 1 to 6 applies.

The essential difference of the example of embodiment shown in FIG. 8 is that a spoiler-like air guide means 82 is formed on the back 50 of the coupling section 26. In order to produce the air guide means 82, a more or less rectangular section which is oriented in the longitudinal direction of the coupling section 26 has been cut free from or punched out of the back 50 of the coupling section 26, at its two narrow sides and on one longitudinal side, and bent upwards out of the plane of the back 50. In this case, the air guide means 82 may be given a rounded, wing-like shape. The air guide means 82 is connected on its longitudinal side facing the incoming air to the back 50. By virtue of the bending-out operation, the opening 80 in the back 50 is made at the same time behind the air guide means 82, which opening can be flowed through by

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a stream of air. In FIG. 8, the reference line belonging to reference 80 is shown in dashed line because the view of the opening 80 is hidden by the air guide means 82 in this perspective view. The air guide means 82 and the opening 80 may be produced from steel sheet as a punched and bent part in a cost-effective manner by punching and bending during the process of manufacturing the coupling section.

The aerodynamic advantages of such a design are on the one hand the pressing force produced by the air guide means, which pressing force acts on the wiper arm 14, and on the other hand the reduction in the dynamic pressure below the U-shape of the coupling section 26.

The special feature of the example of embodiment shown in FIGS. 9 and 10 is that an opening is provided in the back 50 of the coupling section 26 and that a spoiler-like air guide means 84 arranged on the back 32 of the connecting element 24 passes through this opening to the top side of the coupling section 26. When air flows across the air guide means 84, the pressing force of the wiper arm 14 is increased and the lifting force is reduced.

In FIG. 9, it can be seen that the shape and the size of the opening in the coupling section 26 and the base area of the air guide means 84 are adapted to one another. Moreover, the air guide means 84 is connected to the back 32 of the connecting element 24 via a pedestal 86. The height of the pedestal 86 corresponds to the wall thickness of the back 50 of the coupling section 26, so that the top side of the back 50 adjoins the air guide means 84 at least virtually free of any clearance or shoulder. As a result, the aerodynamics are improved and airflow noises are reduced.

Unlike the diagram in FIGS. 9 and 10, the opening in the back 50 of the coupling section 26 may advantageously also be greater than the base area of the air guide means 84 or the pedestal 86 thereof. In this case, only part of the opening would be filled by the air guide means 84. The part of the opening which is not filled thus acts as an airflow opening, and as a result the dynamic pressure below the U-shape of the coupling section 26 is in turn reduced. This embodiment is not shown in the drawing.

Another embodiment which is not shown in the drawing consists in that, in a device as shown in FIGS. 9 and 10, additionally at least one opening is provided in the back and/or in at least one of the legs 52, 54 for reducing the dynamic pressure below the U-shape of the coupling section 26.

A final example of embodiment is shown in FIG. 11. This example of embodiment corresponds in a very large number of features to the embodiment shown in FIG. 2, which is why the fundamental design will not be repeated here and the same reference numerals are used for identical parts and elements.

In the example of embodiment shown in FIG. 11, the slide element 22 has two bearing pins 88 which are arranged so as to be aligned with one another and which project from the slide element 22 transversely with respect to the longitudinal direction of the wiper blade 12. The bearing pins 88, only one of which can be seen in FIG. 11 on account of the perspective view, are made in one piece with the slide element 22. The slide element 22 will advantageously be manufactured as a whole as a diecast metal part or as an injection-moulded plastic part.

Bearing holes 90 which are aligned with one another are formed in the two legs 34 of the connecting element 24, said connecting element having essentially the shape of a U in cross section, once again only one of the bearing holes 90 being visible in FIG. 11 on account of the perspective view. The bearing holes 90 are adapted to the bearing pins 88 in such a way that pivoting of the slide element 22 relative to the

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connecting element 24 can take place in as play-free a manner as possible. One essential difference compared to the embodiment shown in FIG. 2 is that the bearing holes 90 are each opened radially above a slot 92 which runs from the bearing hole 90 towards the lower edge of the leg 34, that is to say the edge opposite the back 32 of the connecting element 24. The slot 92 expands from the edge of the bearing hole 90 towards the edge of the leg 34. The narrow point of the slot 92 is in this case narrower than the diameter of the respective bearing pin 88. Upon assembly or disassembly of the slide element 22 and the connecting element 24, the bearing pins 88 are pressed radially into the bearing holes 90 or out of the latter through the slots 92 in the manner of a locking connection, negotiating the narrow point. As a result, these processes are considerably simplified, and moreover a sufficiently reliable seating or holding of the bearing pins 88 in the bearing holes 90 is ensured.

Usually, the connection of a wiper blade 12 provided with such a slide element 22 and such a connecting element 24 to a wiper arm 14 or to the coupling section 26 of a wiper arm 14, and removal thereof in the opposite direction, take place in the same general manner, as has been described in connection with FIGS. 1 to 6. However, in the embodiment shown in FIG. 11, there is also the possibility firstly of attaching the connecting element 24, separated from the wiper blade 12, in this general way to the coupling section 26 of the wiper arm 14 and then mounting the slide element 22 connected to the wiper blade 12 on the connecting element 24 by pushing the bearing pins 88 radially through the slots 92 into the bearing holes 90. It is also conceivable to carry out a disassembly operation by reversing the sequence of these last-mentioned steps.

Devices for releasably connecting a wiper blade to a wiper arm which correspond to the examples of embodiments shown in FIGS. 1 to 10 are suitable in particular for use in wiper systems for front windcreens of vehicles, whereas the device corresponding to the example of embodiment shown in FIG. 11 is suitable in particular for use in wiper systems for rear windows of vehicles.

All of the features found in the description, the drawings and the claims may be essential to the invention both individually and in any desired combination with one another.

The invention claimed is:

1. A device for releasably connecting a wiper blade to a drivable wiper arm, said device comprising:
 - a connecting element configured to be pivotally coupled to a coupling element of said wiper blade about a pivot; wherein said connecting element comprises a front portion and a rear portion configured to secure said connecting element to said wiper arm when said wiper blade becomes detachably secured to said wiper arm, wherein said front portion is on a front side of said connecting element relative to said pivot and said rear portion is on a rear side of said connecting element relative to said pivot,
 - wherein said front portion defines a first U-shaped indentation having a base away from said pivot and two branches extending from said base toward said pivot,
 - wherein said front portion defines a second U-shaped indentation facing said first U-shaped indentation and having a base toward said pivot and two branches extending from said base away from said pivot.
2. A wiper assembly comprising a drivable wiper arm and the device as recited in claim 1, wherein said wiper arm comprises a coupling section with an insertion section, said

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insertion section being received through said first and second U-shaped indentations when said wiper blade is detachably secured to said wiper arm.

3. The wiper assembly as recited in claim 2 wherein said rear portion of said connecting element comprises a plurality of resilient securing sections for detachably coupling said connecting element to said wiper arm.

4. The wiper assembly as recited in claim 2 wherein said connecting element comprises a shape that is complementary to a shape of the coupling section.

5. The wiper assembly as recited in claim 2 wherein a portion of said insertion section is arc-shaped in cross-section.

6. The wiper assembly as recited in claim 2 wherein when said wiper arm and said connecting element are coupled together, a section of said wiper arm covers at least a middle portion of said connecting element, said middle portion being between said front and rear portions.

7. The wiper assembly as recited in claim 2 wherein when said wiper arm and said connecting element are coupled together, said wiper arm and said connecting element cooperate to define a substantially continuous and smooth surface.

8. The wiper assembly as recited in claim 2, further comprising a spoiler situated on at least one of said wiper arm and said connecting element.

9. The wiper assembly as recited in claim 2 wherein said wiper arm further comprises a spoiler.

10. The wiper assembly as recited in claim 2, further comprising said wiper blade pivotally coupled to said connecting element at said pivot.

11. The wiper assembly as recited in claim 10, wherein said wiper blade comprises a wiper strip configured to wipe a windscreen; an elongate support element supporting said

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wiper strip along said wiper strip; said coupling element connected to said elongate support element over only a portion of said elongate support element, wherein said wiper strip is connected to said elongate support element over said portion of said elongate element that is connected to said coupling element.

12. The device as recited in claim 1 wherein said connecting element is generally U-shaped in cross-section and is defined by a back and two legs.

13. The device as recited in claim 12 wherein said second U-shaped indentation is defined as a cut-out on said back of said connecting element.

14. The device as recited in claim 1 wherein said connecting element includes a coding.

15. The device as recited in claim 1 wherein said connecting element comprises at least one bearing hole for receiving a bolt or a pin that couples said connecting element to said coupling element of said wiper blade.

16. The device as recited in claim 15 wherein said at least one bearing hole comprises a slot for receiving said bolt or pin.

17. The device as recited in claim 1 wherein said rear portion includes two lateral protrusions, each protrusion defining a surface on a front side of said protrusion, said surface being inclined such that a top edge of said surface is nearer said pivot than a bottom edge of said surface.

18. The device as recited in claim 17 wherein said rear portion comprises at least one actuating section.

19. The device as recited in claim 17 wherein each of said lateral protrusions is located on a resilient actuating section for releasing said wiper arm from said connecting element.

* * * * *

Exhibit C



US007891044B2

(12) **United States Patent**
Fink et al.

(10) **Patent No.:** **US 7,891,044 B2**

(45) **Date of Patent:** **Feb. 22, 2011**

(54) **DEVICE FOR DETACHABLY LINKING A WIPER BLADE WITH A DRIVEN WIPER ARM**

(58) **Field of Classification Search** 15/250.31,
15/250.32, 250.201, 250.351, 250.33
See application file for complete search history.

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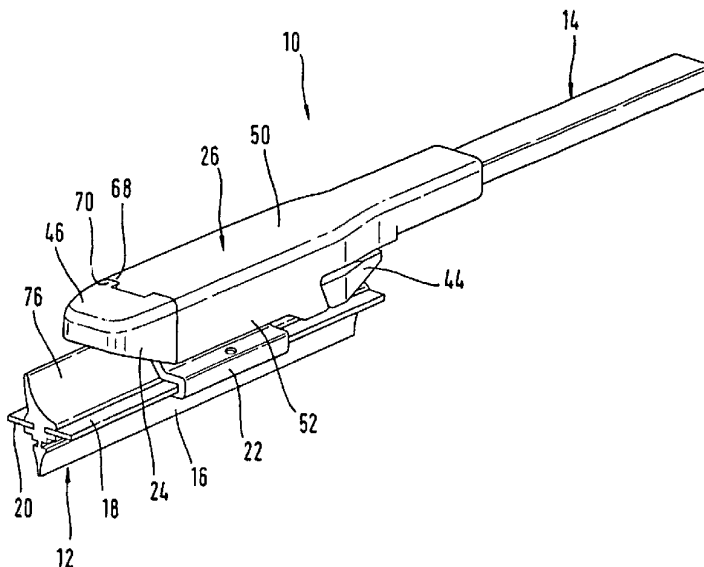
(51) **Int. Cl.**
B60S 1/40 (2006.01)

(52) **U.S. Cl.** **15/250.32; 15/250.513**

(57) **ABSTRACT**

The invention relates to a device and a method for releasably connecting a wiper blade to a drivable wiper arm. In one embodiment, the invention is characterized in that the coupling section has a tongue-like insertion section, in that the connecting element has a seat for the insertion section, and in that the coupling section and the connecting element have securing sections for providing a mutual permanent connection.

33 Claims, 6 Drawing Sheets



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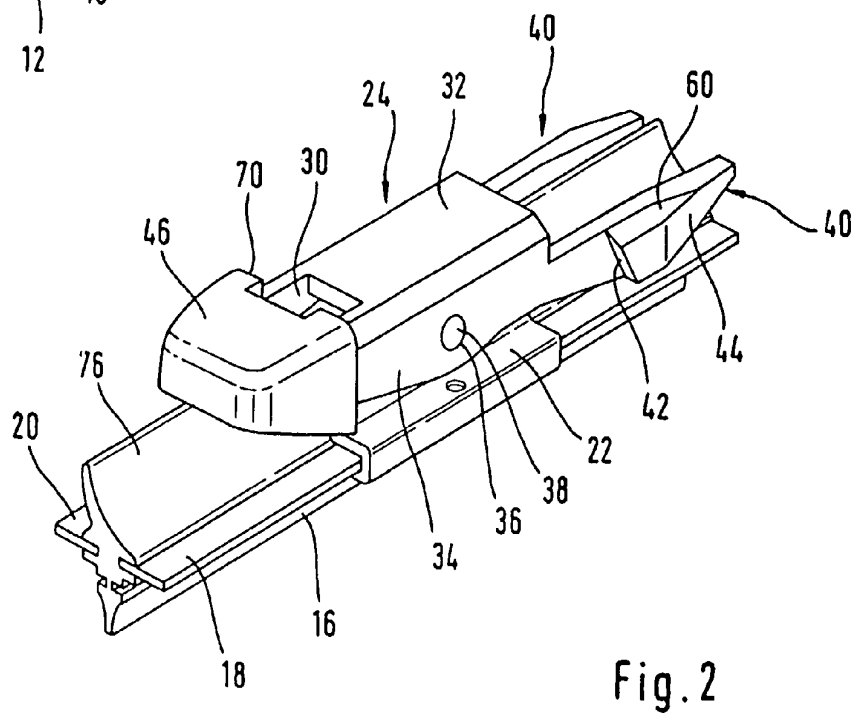
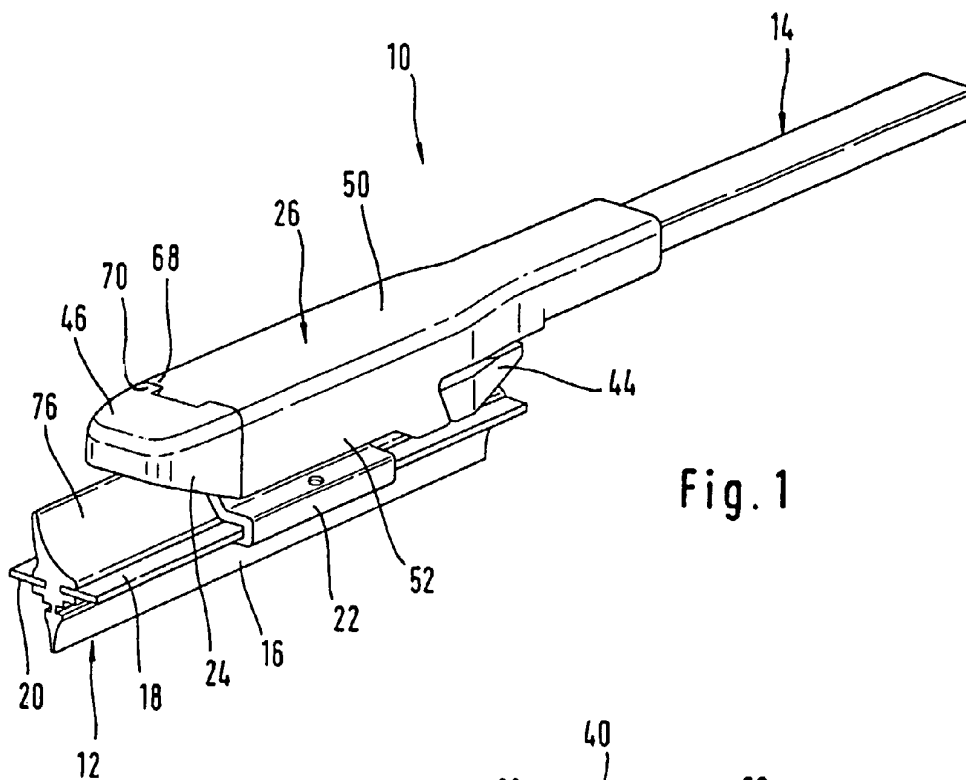


Fig. 3

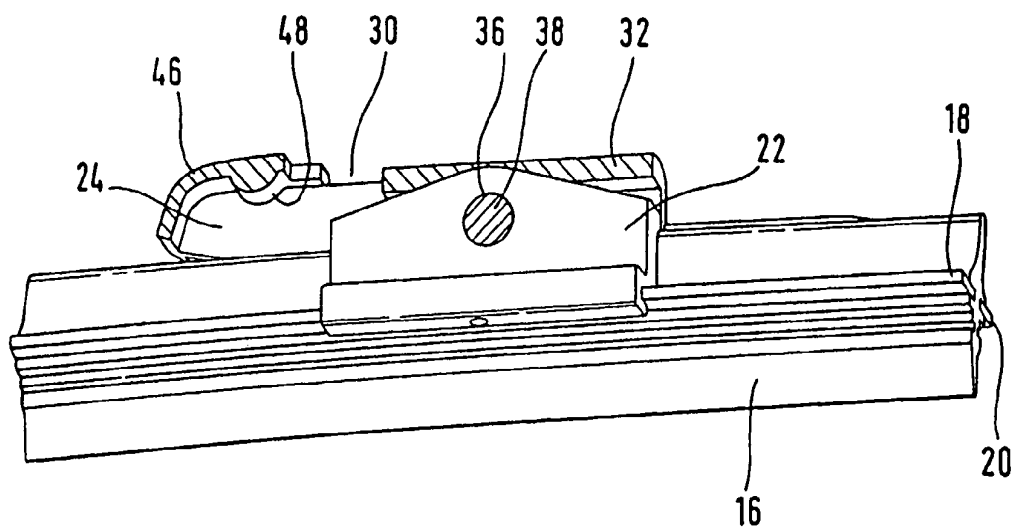
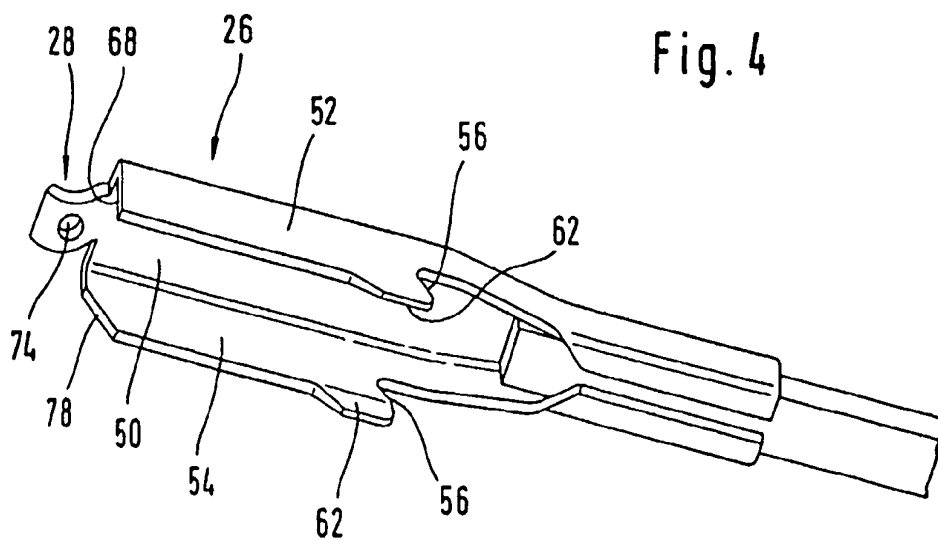


Fig. 4



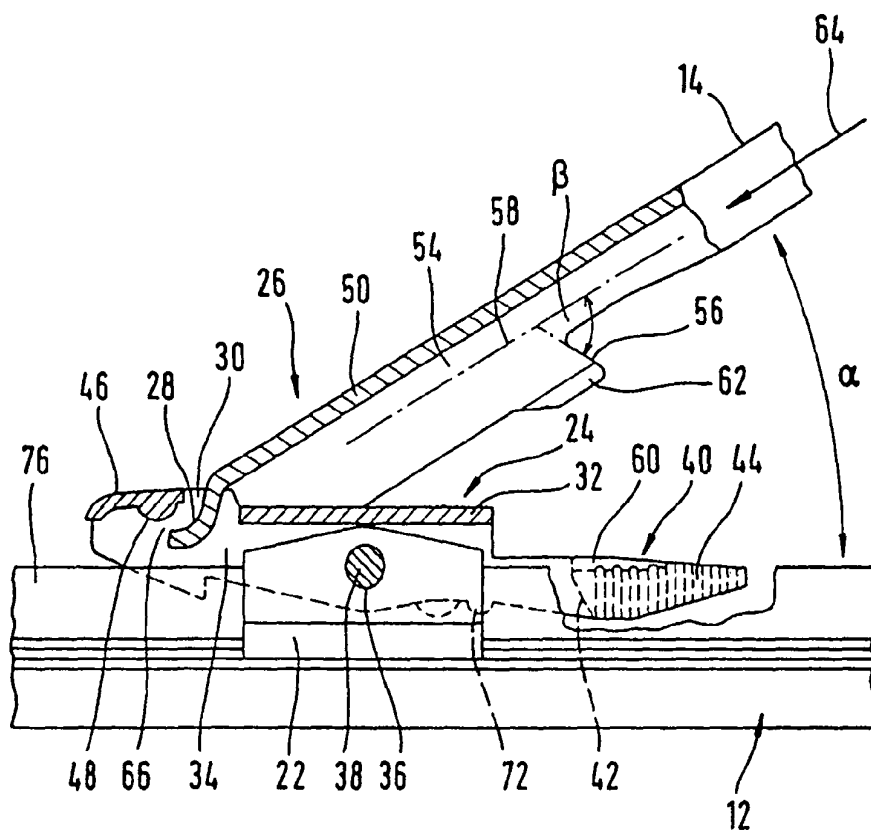


Fig. 5

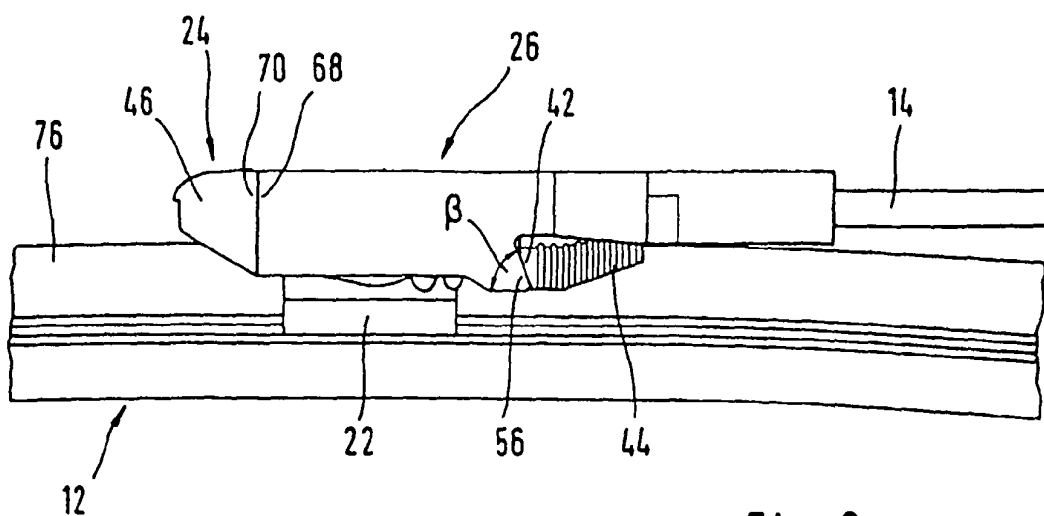
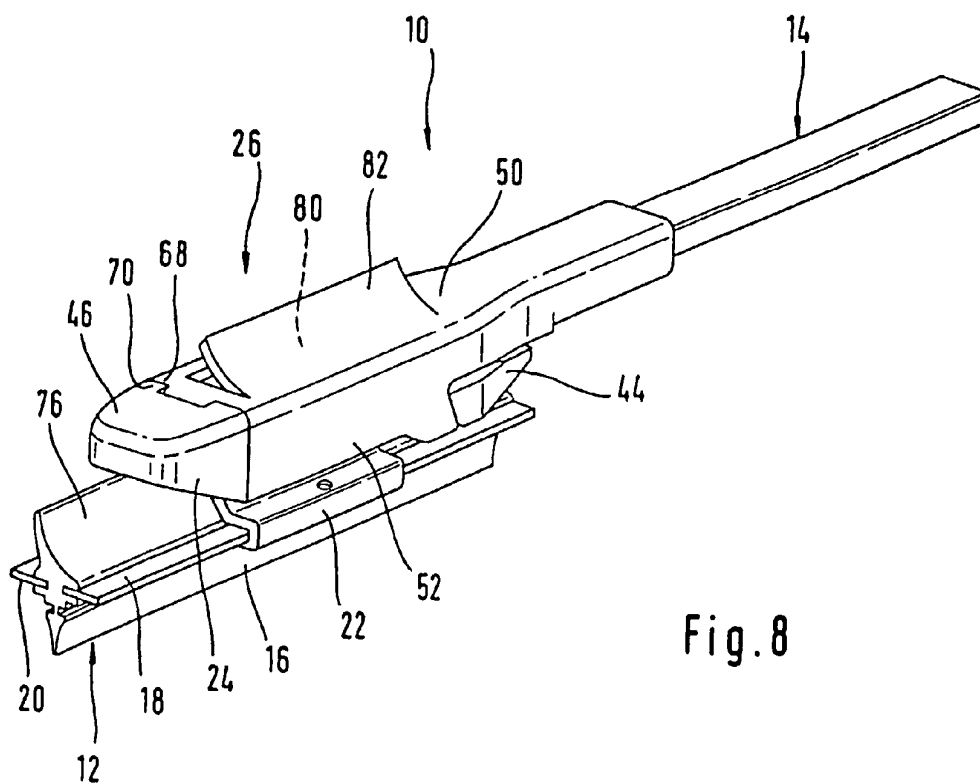
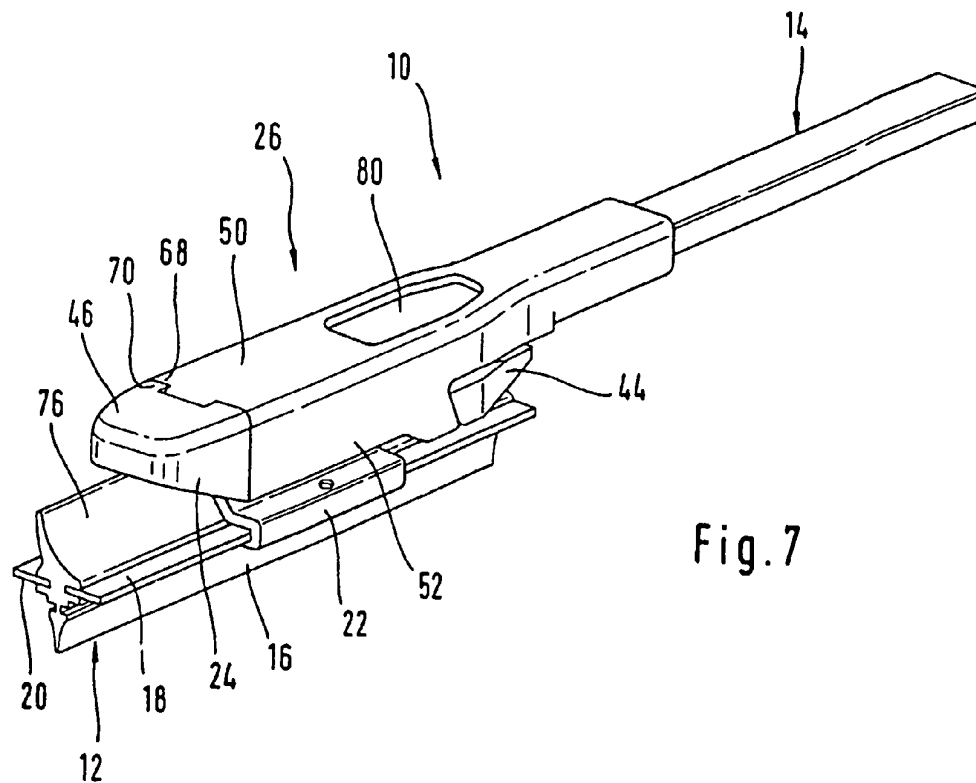


Fig. 6



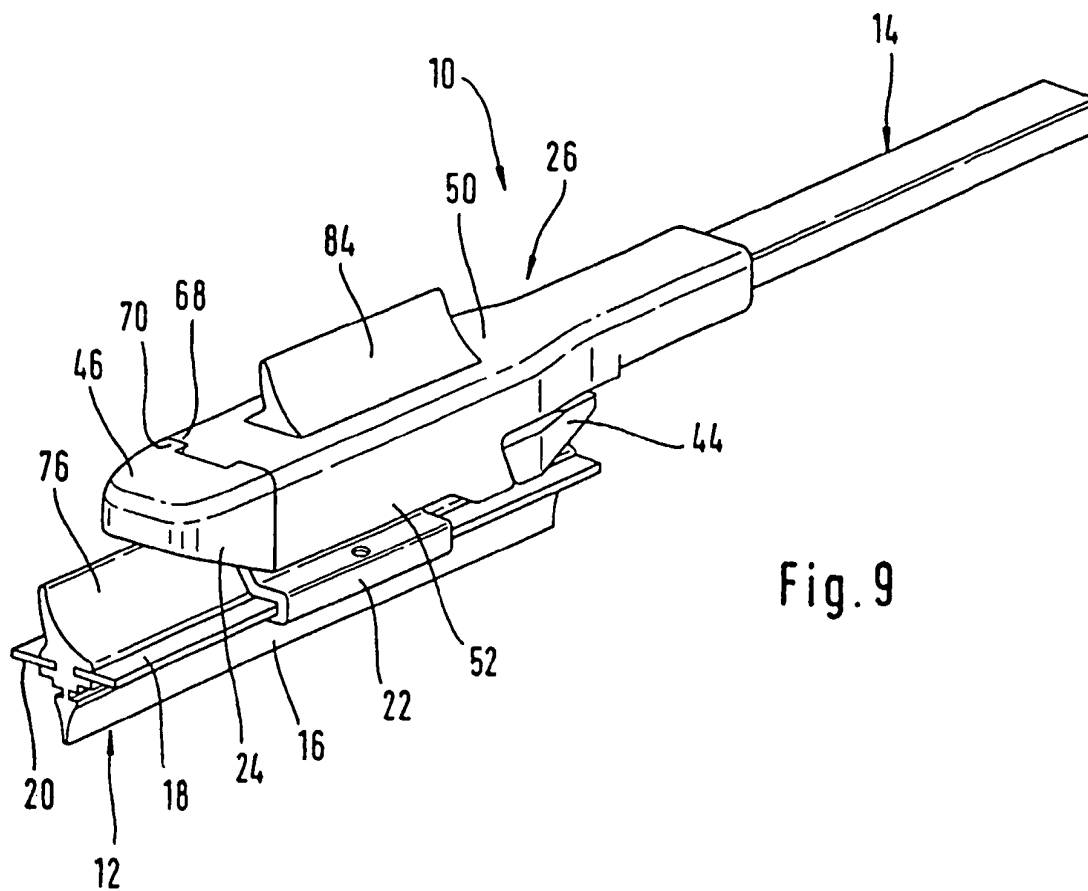


Fig. 9

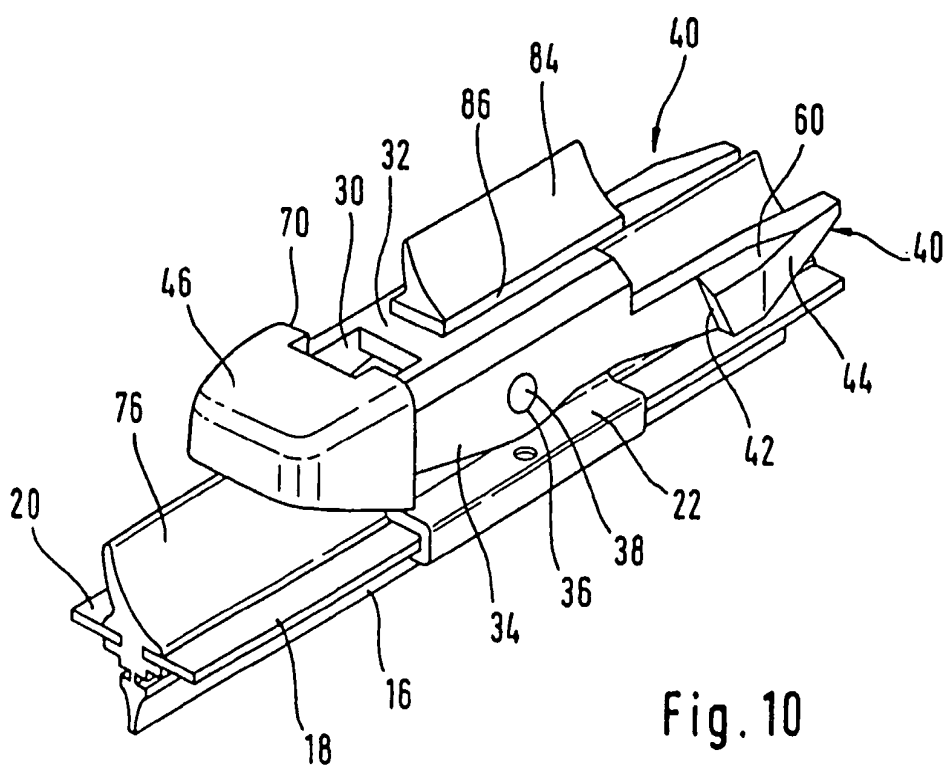


Fig. 10

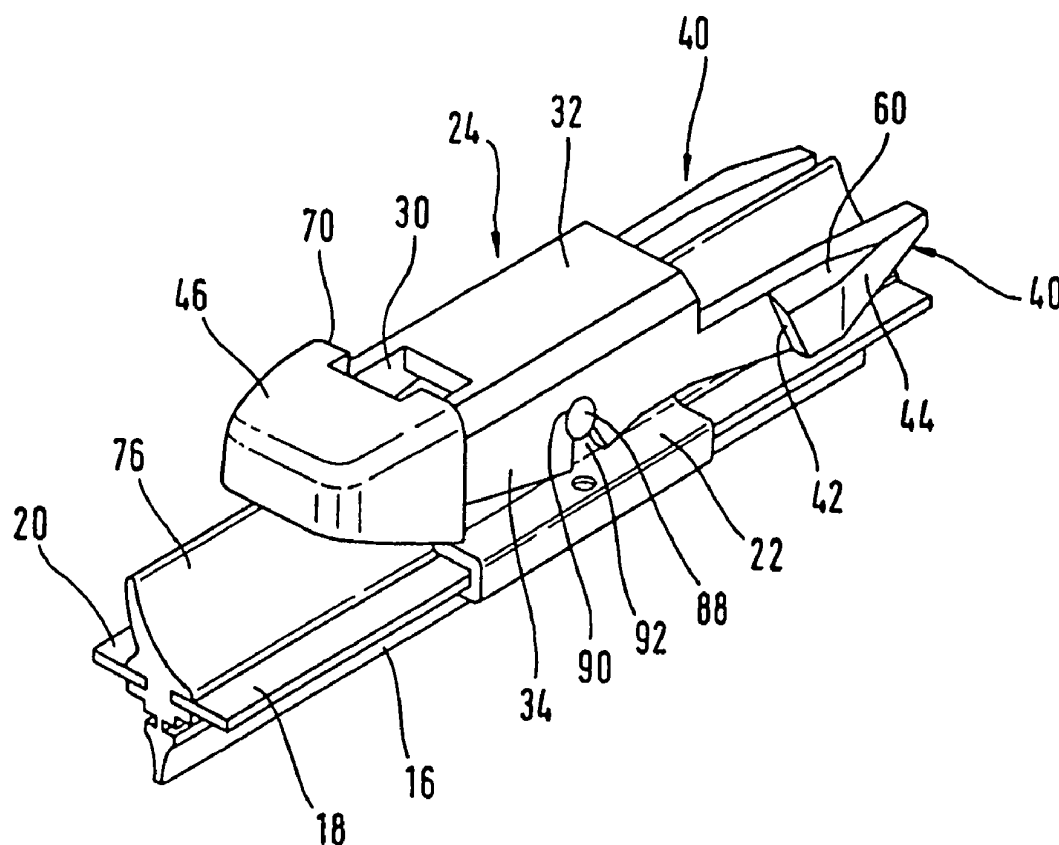


Fig.11

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DEVICE FOR DETACHABLY LINKING A WIPER BLADE WITH A DRIVEN WIPER ARM

BACKGROUND OF THE INVENTION

The invention relates to a device and a method for releasably connecting a wiper blade to a drivable wiper arm, wherein the wiper blade comprises a wiper strip which faces the windscreen to be wiped, at least one strip-like elongate support element, a slide element which is connected to the support element, and a connecting element for connection to a coupling section of the wiper arm, which connecting element is mounted on the slide element in a manner such that it can pivot.

Such a device is known for example from WO 02/40328 A1. The device described therein, by means of which a flat wiper blade can be connected to the coupling section, has a large number of complex components which are difficult to manufacture. Moreover, the operation of connecting the coupling section of the wiper arm to the connecting element of the wiper blade is relatively complex and requires a certain amount of skill.

SUMMARY OF THE INVENTION

So what is needed, therefore, is an improved system and method that improves and simplifies the connection of the wiper arm to the wiper blade.

It is therefore an object of the present invention to propose a device for releasably connecting a wiper blade to a drivable wiper arm, in which the operation of connecting the connecting element to the coupling section can be carried out in a simple manner. Moreover, it is to be ensured that the coupling section is joined in a permanently secure manner to the connecting section, wherein the wiper blade can nevertheless be released from the wiper arm in a simple manner.

According to the invention, this object is achieved by a device of the type described above in that the coupling section has a tongue-like insertion section, in that the connecting element has a seat for the insertion section, and in that the coupling section and the connecting element have securing sections for providing a mutual permanent connection, wherein, in order to reach a preassembly position in which the longitudinal axis of the wiper arm and the longitudinal axis of the connecting element enclose an angle α in the range from approximately 10° to 100° , the insertion section can be inserted in a substantially rectilinear manner into the seat, and wherein, in order to reach a final assembly position, the wiper arm and the connecting section can be pivoted onto one another about the insertion section/seat contact area until the securing sections allow a permanent mutual connection.

The invention has the advantage that only two steps which are simple to carry out are required in order to connect the wiper blade to the wiper arm, namely firstly rectilinear insertion of the insertion section into the seat provided on the connecting element, and pivoting of the coupling section or of the wiper arm and of the connecting element onto one another.

Moreover, such a device has the advantage that it is of a very flat and very narrow design. On the one hand, wind noise is minimized as a result. On the other hand, the view of the vehicle driver is only slightly impaired by the wiper blade and the wiper arm. Furthermore, force introduction preferably takes place over the longitudinal axis of the wiper blade,

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substantially perpendicular to the windscreen to be wiped, and as a result the occurrence of tilting moments is suppressed.

Preferably, the insertion direction for reaching the preassembly position lies in the plane of pivoting for reaching the final assembly position. This has the advantage that the two movements lie in one plane, and as a result the assembly operation is simplified.

One embodiment of the invention is characterized in that the coupling section is designed to be U-shaped in cross section and comprises a back and two legs, wherein the insertion section is designed in a hook-like manner and is arranged in a stand-alone manner on the back of the coupling section.

The coupling section, which is designed to be U-shaped in cross section, advantageously engages over the connecting element at least in part in the final assembly position. As a result, transverse forces acting on the connecting element can be absorbed by the legs of the coupling section.

The insertion section is preferably designed such that it is arc-shaped at the free end, in the direction of the extension of the wiper arm and in side view in the direction of the windscreen to be wiped, in such a manner that it does not protrude beyond the back. This has the advantage that the insertion section, in the final assembly position, does not protrude in a disruptive manner beyond the back of the coupling section. Given a suitably designed connecting element, the insertion section is not visible in the final assembly position.

It is advantageous if the region of the connecting element which cooperates with the insertion section and adjoins the insertion opening is designed to be complementary to the insertion section. In this way it can be ensured, in the final assembly position, that the insertion section bears reliably against the complementarily designed region of the connecting element.

A further embodiment of the invention is obtained when the region of the connecting element and of the insertion section which cooperates with the insertion section is designed to be arc-shaped, and in particular shaped like a segment of a circle, in longitudinal section. When the coupling section and the connecting element are pivoted onto one another in the final assembly position, this ensures that during the pivoting movement the insertion section bears with a substantial part of its surface against the region of the connecting element which cooperates with the insertion section. This ensures reliable guidance when assembling the device from the preassembly position to the final assembly position. Stress peaks are avoided on account of the large-surface bearing.

One further embodiment is obtained when the connecting element is designed to be U-shaped in cross section and comprises a back and two legs. On account of the U-shaped design of the connecting element, a spoiler section of the wiper strip which faces away from the windscreen to be wiped can extend between the two legs of the connecting element in the longitudinal direction of the wiper blade. Furthermore, the connecting element can advantageously be coupled at the legs to the slide.

Advantageously, the insertion opening is designed as a cut-out on the back. This has the advantage that the insertion opening can be clearly seen on the wiper blade in plan view, as a result of which insertion of the insertion section into the insertion opening is simplified.

According to the invention, it is furthermore conceivable that, in the final assembly position, the coupling section covers the connecting element at least in part. In the state mounted on the wiper arm, the inner sides of the legs of the U-shaped coupling section then preferably bear against the

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outer sides of the legs of the U-shaped connecting element. The outer side of the back of the connecting element preferably bears against the inner side of the back of the coupling section.

A further advantageous embodiment of the invention is obtained when the securing sections are designed as locking sections. When the coupling section and the connecting element are pivoted onto one another, the locking sections advantageously lock with one another in the final assembly position.

It may be provided that the connecting element has, on its side facing away from the insertion opening in the longitudinal direction, on the legs, in each case a locking tongue which extends in the longitudinal direction and is elastically flexible in the transverse direction, which locking tongues cooperate with locking edges provided on the legs of the coupling section.

In order to ensure secure locking, it may advantageously be provided that the locking edges of the locking tongues and the locking edges of the legs enclose an acute angle, in particular an angle in the range from approximately 30° to 80°, with the longitudinal axis of the wiper blade in the final assembly position.

In order to release the locking connection, and thus to release the wiper blade from the wiper arm, in a further embodiment of the invention it may be provided that actuating sections are provided on the free ends of the locking tongues. The actuating sections are designed in such a way that the locking tongues can be pressed towards one another, as a result of which the locking edges of the locking tongues can come out of engagement with the locking edges on the legs of the coupling section.

In order to allow easier locking, it is advantageously provided that the sides of the locking tongues which face the back of the coupling section and meet the legs of the coupling section when pivoted into the final assembly position are bevelled.

Easier locking is also assisted if the sides of the legs of the coupling section which face the windscreen and which are met by the facing sides of the locking sections when pivoted into the final assembly position are bevelled. Shortly prior to reaching the final assembly position, the bevelled sides of the locking tongues consequently cooperate with the bevelled sides of the legs of the coupling section in such a way that the locking tongues are pivoted out in directions towards one another. In the final assembly position, the locking tongues snap behind the locking edges of the coupling section in directions facing away from one another.

In order to prevent a wiper blade from being arranged the wrong way round on a wiper arm, the coupling section may have a suitable coding. Incorrect assembly of the wiper blade, for example on the incorrect wiper arm, is thus prevented. A coding may be produced for example by a suitable bezel on the coupling section and by a suitable web on the connecting element which cooperates with the bezel.

A further advantageous embodiment of the invention is obtained when the legs of the connecting element are designed as double-walled legs which are slightly elastically flexible in the transverse direction. Such double-walled legs have a better friction behaviour with respect to the slide element against which they are pivotably arranged. Advantageously, the connecting element has, between the legs, a hinge pin which is mounted in a hole on the slide element for the pivotable arrangement of the connecting element.

Another embodiment of the invention provides that the slide element has a bearing bolt or alternatively two hinge pins which project with their ends from the slide element and

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on which the connecting element is pivotably mounted by bearing holes in its legs, which bearing holes are designed in a corresponding manner and are arranged so as to be aligned. In this case, the bearing bolt is or the bearing pins are connected fixedly against rotation to the slide element, and the connecting element is mounted on the slide element in a manner such that it can rotate or pivot. When a wiper blade is replaced, therefore, the entire bearing device is exchanged.

According to a further embodiment of the invention, the bearing holes provided in the legs of the connecting element are opened above in each case a slot towards the edge, which slot runs radially with respect to the bearing hole. This may advantageously be used to simplify the assembly of the individual parts.

According to another embodiment, if the slot in each case runs from the bearing hole to the edge of the leg which lies opposite the back of the connecting element, the risk of the bearing bolt or bearing pin undesirably sliding out of the bearing hole is small.

One further advantageous embodiment provides that in each case the slot expands from the bearing hole towards the edge of the leg, wherein the narrowest point of the slot is smaller than the diameter of the bearing bolt or the alternative bearing pins. This embodiment allows simplification of assembly and disassembly. The bearing bolt or bearing pins can be pressed in radially through the slot in the manner of a locking connection, negotiating the narrow point. Likewise, the bearing bolt or bearing pins can also be removed in the opposite direction, again negotiating the narrow point. To this end, it may be necessary for the connecting element to be made of a suitable plastics material which allows the narrow point of the slot to be negotiated by the bearing bolt or bearing pins. The slide element and/or the bearing bolt or the bearing pins may be made of metal or likewise made of a suitable plastics material.

A further, advantageous embodiment of the invention provides that the legs of the connecting element have stud-like raised areas on the side facing the windscreen. These raised areas serve for support on either the wiper rubber or the support element, as a result of which easier assembly and disassembly of the wiper blade is made possible.

The coupling section and the connecting element are preferably designed in such a way that, in the final assembly position, they have a substantially closed and substantially smooth surface. To this end, the sections of the connecting element which are covered by the coupling section may lie deeper than the sections of the connecting element which are visible in the final assembly position, the difference in depth being the wall thickness of the coupling section.

Further advantageous refinements are provided in order to improve the aerodynamic behaviour of the wiper arm/wiper blade combination, particularly at high travelling speeds or airflow velocities, and thus to counteract in particular the known effect of lifting of the wiper blade connected to the wiper arm off the windscreen to be wiped.

By virtue of the measure that the coupling section of the wiper arm has at least one opening suitable for air to flow through, a dynamic pressure which arises below the U-shape of the coupling section is substantially broken down. As a result, the lifting force on the wiper arm is reduced.

It is particularly advantageous to provide the at least one opening in the back of the coupling section. However, an improvement is also possible if one or more airflow openings are placed in the legs of the coupling section, in particular in the lee-side leg. The maximum effect can probably be achieved by a combination of the individual possibilities.

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Another embodiment provides that at least one spoiler-like air guide means is provided on the coupling section of the wiper arm. In this way, the incoming air can be guided in such a way that the effect of the wiper blade or wiper arm being lifted off the windscreen is counteracted. It is advantageous in this connection for the at least one air guide means to be arranged on the back of the coupling section. A spoiler acts particularly effectively at this location.

The advantages of an embodiment, according to which the air guide means is formed by a section cut free from the back of the coupling section and bent upwards in a spoiler-like manner, are to be seen in the combination of the effects of the spoiler and of the airflow opening formed in this way. The pressing force is thus directly increased and at the same time the dynamic pressure inside the coupling section is reduced. Moreover, an air guide means produced in this way is particularly cost-effective.

A further advantageous embodiment provides that at least one spoiler-like air guide means which is preferably made in one piece with the connecting element is arranged on the back of the connecting element, and that this at least one air guide means protrudes through a, preferably corresponding, opening in the back of the coupling section. Since the connecting element is advantageously made of plastics material, a very large number of design possibilities are provided for the shape of the spoiler-like air guide means with regard to particularly favourable fluidic properties.

The object mentioned in the introduction is also achieved by a method of assembling a device according to the invention, which method is characterized in that, in order to reach a preassembly position in which the longitudinal axis of the wiper arm and the longitudinal axis of the connecting element enclose an angle α in the range from approximately 10° to 100° , the insertion section is inserted in a substantially rectilinear manner into the seat, and in that, in order to reach a final assembly position, the wiper arm and the connecting section can be pivoted onto one another about the insertion section/seat contact area until the securing sections enter into a permanent mutual connection.

Further details and advantages of the invention can be found in the following description in which the invention is described and explained in more detail with reference to examples of embodiments shown in the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 shows a device according to the invention in a perspective view;

FIG. 2 shows the device of FIG. 1 without the wiper arm;

FIG. 3 shows a partial section through FIG. 2;

FIG. 4 shows a view from below of the coupling section shown in FIG. 1;

FIG. 5 shows a partial section through the device of FIG. 1 in a preassembly position;

FIG. 6 shows a partial section through the device of FIG. 5 in the final assembly position;

FIG. 7 shows another embodiment of a device according to the invention in a perspective view;

FIG. 8 shows a further embodiment of a device according to the invention in a perspective view;

FIG. 9 shows a final embodiment of a device according to the invention in a perspective view;

FIG. 10 shows the device of FIG. 9 without the wiper arm; and

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FIG. 11 shows another embodiment of a device according to the invention without the wiper arm.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a device 10 according to the invention for releasably connecting a wiper blade 12, shown in part, to a drivable wiper arm 14 which is likewise shown in part. The wiper blade 12 has a wiper strip 16 which faces the windscreen to be wiped (not shown) and comprises two strip-like elongate support elements 18, 20, a slide element 22 which is connected to the support elements 18, 20, and a connecting element 24 which is arranged on the slide element 22 in a manner such that it can pivot. The connecting element 24 serves for connection to a coupling section 26 on the wiper arm 14.

The coupling section 26 has, as can be seen in particular in FIG. 4, a tongue-like insertion section 28 which, in the final assembly position shown in FIGS. 1 and 6, engages in a seat 30 which can be clearly seen in FIG. 2. The connecting element 24, which like the coupling section 26 is U-shaped in cross section, has a back 32 and two legs 34. The seat 30 is provided in the back 32 of the connecting element 24. A bearing hole 36 for a bearing bolt 38, which bearing hole extends in the transverse direction, is provided on the legs 34 of the connecting element 24. On account of the bearing hole 36, and the bearing bolt 38, a pivoting arrangement of the connecting element 24 with respect to the slide element 22 is obtained. In order to achieve a certain flexibility of the legs 34 while having sufficient stiffness, the legs 34 are designed to be double-walled.

As can likewise be seen from FIG. 2, the connecting element 24 has, on its side facing away from the insertion opening 30 in the longitudinal direction, on the legs 34, in each case a locking tongue 40 which extends in the longitudinal direction and is elastically flexible in the transverse direction. The locking tongues 40 each comprise a locking edge 42 and an actuating section 44. The region of the connecting element 24 which is covered by the coupling section 26 in the final assembly position is set back from the other regions of the connecting element 24 which are formed essentially by the two actuating sections 44 and a head section 46 which lies in the axial extension of the coupling section. As a result, in the final assembly position, the coupling section 26 and the connecting element 24 form a substantially closed and substantially smooth surface.

As can be seen from FIG. 3, the region 48 which cooperates with the insertion section 28 and adjoins the insertion opening 30 is designed to be complementary to the insertion section 28. As can be seen from FIGS. 4 and 5, the insertion section 28 is designed in an arc-shaped manner in the direction of the extension of the wiper arm 14 and in side view in the direction of the windscreen to be wiped. Correspondingly, as can be seen from FIGS. 3 and 5, the region 48 is likewise designed to be arc-shaped, in particular in the shape of a segment of a circle.

It can be seen from FIG. 4 that the coupling section is designed in a U-shaped manner in cross section and has a back 50 and legs 52, 54 which adjoin the back. The insertion section 28 is in this case arranged in a stand-alone manner in the extension of the back 50. Provided on the legs 52, 54 are locking edges 56 which enclose an angle β of approximately 70° with the longitudinal axis 58 of the wiper arm 14 (FIGS. 5 and 6). The locking edges 42 of the locking tongues 40 enclose a corresponding angle β . In the final assembly posi-

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tion shown in FIG. 6, the locking edges 42 of the locking tongues 40 bear against the locking edges 56 of the legs 52, 54 of the coupling section 26.

It can be seen from FIGS. 2 and 5 that the sides 60 of the locking tongues 40 which face the back 50 of the coupling section 26 are slightly bevelled. In a corresponding manner, the sides 62 of the legs of the coupling section 26 which face the windscreen and cooperate with the sides 60 of the coupling section 26 when pivoted into the final assembly position are also slightly bevelled.

For assembly of the coupling section 26 to the connecting element 24, in order to reach a preassembly position which is shown in FIG. 5, the insertion section 28 is inserted into the seat 30 in a substantially rectilinear manner in the direction of the arrow 64. In this preassembly position, the longitudinal axis of the wiper arm 14 and the longitudinal axis of the connecting element 24 or of the wiper blade 12 enclose an angle α which may lie in the range from approximately 10 to 100°. In the example of embodiment shown in FIG. 5, the angle α has a value of approximately 40°. In order to reach the final assembly position, which is shown in FIG. 1 and FIG. 6, the wiper arm 14 and the connecting section 24 are pivoted onto one another about the contact area 66 in which the insertion section 28 bears against the region 48 of the seat 30. On account of the complementary design of the insertion section 28 and the region 48, the pivoting operation is carried out to a limited extent. Shortly prior to reaching the final assembly position, the bevelled sides 62 of the coupling section 26 and the correspondingly bevelled sides 60 of the locking tongues 40 meet one another in such a way that the locking tongues 40 are pivoted elastically in a direction facing one another. Upon reaching the final assembly position, the locking tongues 40 snap behind the locking edges 56 of the legs 52, 54 of the coupling section 26 in a direction facing away from one another. As a result, the coupling section 26 is permanently held on the connecting element 24 in the final assembly position. In the final assembly position, the coupling section 28 bears against the region 48 of the connecting element 24 over a large part of its surface. Furthermore, the end side 68 of the coupling section 26 which faces the head area 46 of the connecting element 26 bears against a bearing edge 70 of the connecting element which corresponds thereto.

On account of the locking edges 42, 56 which are not perpendicular to the longitudinal axis of the wiper blade but rather enclose an acute angle β with the longitudinal axis, in the assembled state the coupling section 26 is acted upon in the direction of the head section 46. As a result, a play-free connection is obtained in the axial direction. Moreover, by virtue of the obliquely arranged locking edges 42, 56, the coupling section 26 is acted upon in the direction of the wiper blade 12, as a result of which a play-free connection is produced in the direction perpendicular to the wiper blade. The insertion section 28 in this case bears against the contact region 48 of the connecting element 24 with slight prestress.

In order to release the connection, the actuating sections 44 are pressed towards one another. As a result, the locking edges 42 of the locking tongues 40 come out of the engagement region of the locking edges 56 of the coupling section 26. Since the actuating sections are arranged opposite one another, the actuating sections 44 can be pressed together by a simple hand grip, using one hand. The coupling section 26 is then pivoted away from the connecting element 24 until the preassembly position reached in FIG. 5 is almost reached. The insertion section 28 is then moved out of the seat 30 in the direction counter to the arrow 64.

As can be clearly seen in FIG. 5, it may be provided that the legs 34 of the connecting element have stub-like raised areas 72 on the side facing the windscreen. These raised areas serve for support on the slide element 22. The raised areas 72 restrict the pivoting range of the connecting element 24 with

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respect to the slide element 22. As a result, easier assembly and disassembly of the wiper blade 12 from the wiper arm 14 is possible.

In the bent region of the insertion section 28, a material cut-out in the form of a cylindrical hole 74 is provided.

In order to prevent it from being possible for the wiper blade, which has a spoiler-like projection 76 on its side facing away from the wiper strip 16, to be mounted on the incorrect wiper arm, a coding may be provided on the connecting element 24 and on the coupling section 26. Such a coding may be formed for example by a bevelled corner 78 on the leg 54 of the coupling section 26, as shown in a corresponding manner in FIG. 4. The bevelled corner 78 may in this case correspond to a material deposit at the corresponding location on the connecting element 24, which material deposit is designed in a complementary manner and is not shown in the figures. Since only one of two wiper blades, the respective right-hand or left-hand wiper blade, has a corresponding material deposit on the connecting element, a clear assignment of the right-hand or left-hand wiper blade to the right-hand or left-hand wiper arm is ensured.

For the example of embodiment shown in FIG. 7, in general the same description as above in respect of the first example of embodiment shown in FIGS. 1 to 6 applies. The same references have thus been used in FIG. 7 as in FIG. 1.

The essential difference of the example of embodiment shown in FIG. 7 is that an opening 80 is additionally provided in the back 50 of the coupling section 26 belonging to the wiper arm 14. This opening 80 makes it possible for air flowing below the U-shape of the coupling section to leave the space formed below the U-shape on a relatively short path by flowing through the opening 80. In this way, the dynamic pressure below the coupling section 26 is reduced compared to an embodiment without the opening 80, and this leads to a comparative reduction in the lifting force of the wiper arm 14 as air flows through.

Instead of the one opening 80, it would also be possible for a number of openings 80 to be provided in the coupling section 26, wherein one or more openings 80 may also be made in one of the two legs 52, 54 or in both legs 52, 54. The size, shape and position of the one or more openings 80 should be optimized with regard to as considerable an effect as possible in a manner depending on the geometric conditions of the individual components of the device 10 and of the device 10 as a whole. Likewise, the shape and size of the one or more openings 80 may be adapted to the design of the coupling section 26.

Also for the further example of embodiment shown in FIG. 8, the same description as that given above in respect of the first example of embodiment shown in FIGS. 1 to 6 applies.

The essential difference of the example of embodiment shown in FIG. 8 is that a spoiler-like air guide means 82 is formed on the back 50 of the coupling section 26. In order to produce the air guide means 82, a more or less rectangular section which is oriented in the longitudinal direction of the coupling section 26 has been cut free from or punched out of the back 50 of the coupling section 26, at its two narrow sides and on one longitudinal side, and bent upwards out of the plane of the back 50. In this case, the air guide means 82 may be given a rounded, wing-like shape. The air guide means 82 is connected on its longitudinal side facing the incoming air to the back 50. By virtue of the bending-out operation, the opening 80 in the back 50 is made at the same time behind the air guide means 82, which opening can be flowed through by a stream of air. In FIG. 8, the reference line belonging to reference 80 is shown in dashed line because the view of the opening 80 is hidden by the air guide means 82 in this perspective view. The air guide means 82 and the opening 80 may be produced from steel sheet as a punched and bent part in a

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cost-effective manner by punching and bending during the process of manufacturing the coupling section.

The aerodynamic advantages of such a design are on the one hand the pressing force produced by the air guide means, which pressing force acts on the wiper arm **14**, and on the other hand the reduction in the dynamic pressure below the U-shape of the coupling section **26**.

The special feature of the example of embodiment shown in FIGS. **9** and **10** is that an opening is provided in the back **50** of the coupling section **26** and that a spoiler-like air guide means **84** arranged on the back **32** of the connecting element **24** passes through this opening to the top side of the coupling section **26**. When air flows across the air guide means **84**, the pressing force of the wiper arm **14** is increased and the lifting force is reduced.

In FIG. **9**, it can be seen that the shape and the size of the opening in the coupling section **26** and the base area of the air guide means **84** are adapted to one another. Moreover, the air guide means **84** is connected to the back **32** of the connecting element **24** via a pedestal **86**. The height of the pedestal **86** corresponds to the wall thickness of the back **50** of the coupling section **26**, so that the top side of the back **50** adjoins the air guide means **84** at least virtually free of any clearance or shoulder. As a result, the aerodynamics are improved and airflow noises are reduced.

Unlike the diagram in FIGS. **9** and **10**, the opening in the back **50** of the coupling section **26** may advantageously also be greater than the base area of the air guide means **84** or the pedestal **86** thereof. In this case, only part of the opening would be filled by the air guide means **84**. The part of the opening which is not filled thus acts as an airflow opening, and as a result the dynamic pressure below the U-shape of the coupling section **26** is in turn reduced. This embodiment is not shown in the drawing.

Another embodiment which is not shown in the drawing consists in that, in a device as shown in FIGS. **9** and **10**, additionally at least one opening is provided in the back and/or in at least one of the legs **52**, **54** for reducing the dynamic pressure below the U-shape of the coupling section **26**.

A final example of embodiment is shown in FIG. **11**. This example of embodiment corresponds in a very large number of features to the embodiment shown in FIG. **2**, which is why the fundamental design will not be repeated here and the same reference numerals are used for identical parts and elements.

In the example of embodiment shown in FIG. **11**, the slide element **22** has two bearing pins **88** which are arranged so as to be aligned with one another and which project from the slide element **22** transversely with respect to the longitudinal direction of the wiper blade **12**. On the bearing pins **88**, only one of which can be seen in FIG. **11** on account of the perspective view, are made in one piece with the slide element **22**. The slide element **22** will advantageously be manufactured as a whole as a diecast metal part or as an injection-moulded plastic part.

Bearing holes **90** which are aligned with one another are formed in the two legs **34** of the connecting element **24**, said connecting element having essentially the shape of a U in cross section, once again only one of the bearing holes **90** being visible in FIG. **11** on account of the perspective view. The bearing holes **90** are adapted to the bearing pins **88** in such a way that pivoting of the slide element **22** relative to the connecting element **24** can take place in as play-free a manner as possible. One essential difference compared to the embodiment shown in FIG. **2** is that the bearing holes **90** are each opened radially above a slot **92** which runs from the bearing hole **90** towards the lower edge of the leg **34**, that is to say the edge opposite the back **32** of the connecting element **24**. The slot **92** expands from the edge of the bearing hole **90** towards the edge of the leg **34**. The narrow point of the slot **92** is in this

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case narrower than the diameter of the respective bearing pin **88**. Upon assembly or disassembly of the slide element **22** and the connecting element **24**, the bearing pins **88** are pressed radially into the bearing holes **90** or out of the latter through the slots **92** in the manner of a locking connection, negotiating the narrow point. As a result, these processes are considerably simplified, and moreover a sufficiently reliable seating or holding of the bearing pins **88** in the bearing holes **90** is ensured.

Usually, the connection of a wiper blade **12** provided with such a slide element **22** and such a connecting element **24** to a wiper arm **14** or to the coupling section **26** of a wiper arm **14**, and removal thereof in the opposite direction, take place in the same general manner, as has been described in connection with FIGS. **1** to **6**. However, in the embodiment shown in FIG. **11**, there is also the possibility firstly of attaching the connecting element **24**, separated from the wiper blade **12**, in this general way to the coupling section **26** of the wiper arm **14** and then mounting the slide element **22** connected to the wiper blade **12** on the connecting element **24** by pushing the bearing pins **88** radially through the slots **92** into the bearing holes **90**. It is also conceivable to carry out a disassembly operation by reversing the sequence of these last-mentioned steps.

Devices for releasably connecting a wiper blade to a wiper arm which correspond to the examples of embodiments shown in FIGS. **1** to **10** are suitable in particular for use in wiper systems for front windscreens of vehicles, whereas the device corresponding to the example of embodiment shown in FIG. **11** is suitable in particular for use in wiper systems for rear windows of vehicles.

All of the features found in the description, the drawings and the claims may be essential to the invention both individually and in any desired combination with one another.

While the method herein described, and the form of apparatus for carrying this method into effect, constitute preferred embodiments of this invention, it is to be understood that the invention is not limited to this precise method and form of apparatus, and that changes may be made in either without departing from the scope of the invention, which is defined in the appended claims.

What is claimed is:

1. Device for releasably connecting a wiper blade to a drivable wiper arm, wherein the wiper blade comprises a wiper strip which faces the windscreen to be wiped, at least one strip-shaped elongate support element, a slide element which is connected to the support element, and a connecting element for connection to a coupling section of the wiper arm, wherein the connecting element is mounted on the slide element in a manner such that it can pivot, wherein the coupling section has a tongue-shaped insertion section, wherein the connecting element has a seat for the insertion section, and wherein the coupling section and the connecting element have securing sections for providing a mutual permanent connection, wherein, in order to reach a preassembly position in which the longitudinal axis of the wiper arm and the longitudinal axis of the connecting element enclose an angle α in the range from approximately 10° to 100° , the insertion section can be inserted in a substantially rectilinear manner into the seat, and wherein, in order to reach a final assembly position, the wiper arm and the connecting section can be pivoted onto one another about the insertion section/seat contact area until the securing sections allow a permanent mutual connection.

2. Device according to claim 1, wherein an insertion direction for reaching a preassembly position lies in a plane of pivoting for reaching the final assembly position.

3. Device according to claim 1, wherein said coupling section is designed to be U-shaped in cross section and com-

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prises a back and two legs, wherein the insertion section is generally hook-shaped and is arranged on the back of the coupling section.

4. Device according to claim 3, wherein said insertion section comprises an arc-shaped end, in the direction of the extension of the wiper arm and in side view in the direction of the windscreen to be wiped, in such a manner that it does not protrude beyond the back.

5. Device according to claim 1, wherein a region of the connecting element which cooperates with the insertion section and adjoins the insertion opening is designed to be complementary to the insertion section.

6. Device according to claim 1, wherein said region of the connecting element and of the insertion section which cooperates with the insertion section is designed to be arc-shaped.

7. Device according to claim 1, wherein said connecting element is designed to be U-shaped in cross section and comprises a back and two legs.

8. Device according to claim 1, wherein said seat comprises an insertion opening designed as a cut-out on the back.

9. Device according to claim 1, wherein, in the final assembly position, the coupling section covers the connecting element at least in part.

10. Device according to claim 1, wherein said securing sections are designed as locking sections.

11. Device according to claim 1, wherein said connecting element has, on its side facing away from the insertion opening in the longitudinal direction, legs, in each case a locking tongue which extends in the longitudinal direction and is elastically flexible in the transverse direction, which locking tongues cooperate with locking edges provided on the legs of the coupling section.

12. Device according to claim 11, wherein said locking edges of the locking tongues and the locking edges of the legs enclose an acute angle (β), in particular an angle in the range from approximately 30° to 80°, with the longitudinal axis.

13. Device according to claim 11, wherein actuating sections for releasing the locking connection are provided on the free ends of the locking tongues.

14. Device according to claim 11, wherein said sides of the locking tongues which face the back of the coupling section are suitably bevelled for easier locking.

15. Device according to claim 11, wherein said sides of the legs of the coupling section which face the windscreen are suitably bevelled for easier locking.

16. Device according to claim 11, wherein said connecting element and the coupling section have a coding.

17. Device according to claim 1, wherein said legs of the connecting element comprises legs that are double-walled legs.

18. Device according to claim 1, wherein said connecting element has, legs, and a hinge pin between the legs which is mounted in a hole on the slide element for the pivotable arrangement of the connecting element.

19. Device according to claim 19, wherein said slide element has a bearing bolt or alternatively two hinge pins which project with their ends from the slide element and on which the connecting element is pivotably mounted by bearing holes in its legs, which bearing holes are designed in a corresponding manner and are arranged so as to be aligned.

20. Device according to claim 19, wherein said bearing holes provided in the legs of the connecting element are opened above in each case a slot which runs radially with respect to the bearing hole.

21. Device according to claim 20, wherein said slots run from the bearing hole to an edge of the leg which lies opposite the back of the connecting element.

22. Device according to claim 20, wherein in each case the slot expands from the bearing hole towards an edge of the leg,

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wherein the narrowest point of the slot is smaller than the diameter of the bearing bolt or the alternative two hinge pins.

23. Device according to claim 1, wherein connecting element comprises legs having stud-shaped raised areas on the side facing the windscreen.

24. Device according to claim 1, wherein, in a final assembly position, the coupling section and the connecting element have a substantially closed, substantially continuous and substantially smooth surface.

25. Device according to claim 1, wherein said coupling section of the wiper arm has at least one opening suitable for air to flow through.

26. Device according to claim 25, wherein said at least one opening is provided in the back of the coupling section.

27. Device according to claim 1, wherein at least one spoiler-shaped air guide means is provided on the coupling section of the wiper arm.

28. Device according to claim 27, wherein said at least one spoiler-shaped air guide means is arranged on the back of the coupling section.

29. Device according to claim 28, wherein said air guide means is formed by a section cut free from the back of the coupling section and bent upwards in a spoiler-shaped manner.

30. Device according to claim 1, wherein at least one spoiler-shaped air guide means is preferably made in one piece with the connecting element is arranged on a back of the connecting element, and in that this at least one air guide means protrudes through a, preferably corresponding, an opening in the back of the coupling section.

31. A device for releaseably connecting a wiper blade to a drivable wiper arm having a coupling section, said device comprising:

a connecting element coupled to said wiper blade;
said connecting element being pivotally coupled to one end of the coupling section;

at least one securing section for securing said connecting element to said coupling section when said connecting element is pivoted to a closed position whereupon said wiper blade becomes detachably secured to said wiper arm;

wherein said securing section comprises a plurality of resilient securing sections for detachably coupling said connecting element to said wiper arm when said connecting element is pivoted to said closed position; and
wherein said plurality of resilient securing sections define a plurality of resilient locking sections.

32. A device for releaseably connecting a wiper blade to a drivable wiper arm having a coupling section, said device comprising:

a connecting element coupled to said wiper blade;
said connecting element being pivotally coupled to one end of the coupling section; and

at least one securing section for securing said connecting element to said coupling section when said connecting element is pivoted to a closed position whereupon said wiper blade becomes detachably secured to said wiper arm; and

wherein said at least one securing section comprises a plurality of elastically flexible locking tongues for engaging legs of said coupling section in order to lock said connecting element to said coupling section.

33. The device as recited in claim 32 wherein said locking tongues enclose an acute angle with a longitudinal axis of said coupling section.

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